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INSTITUTE OF THE AERONAUTICAL SCIENCES

JANUARY 1944

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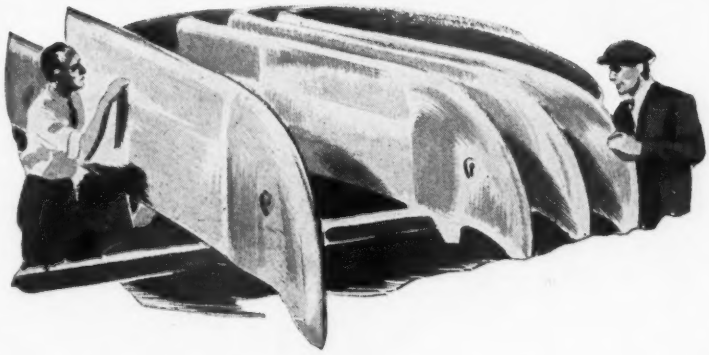

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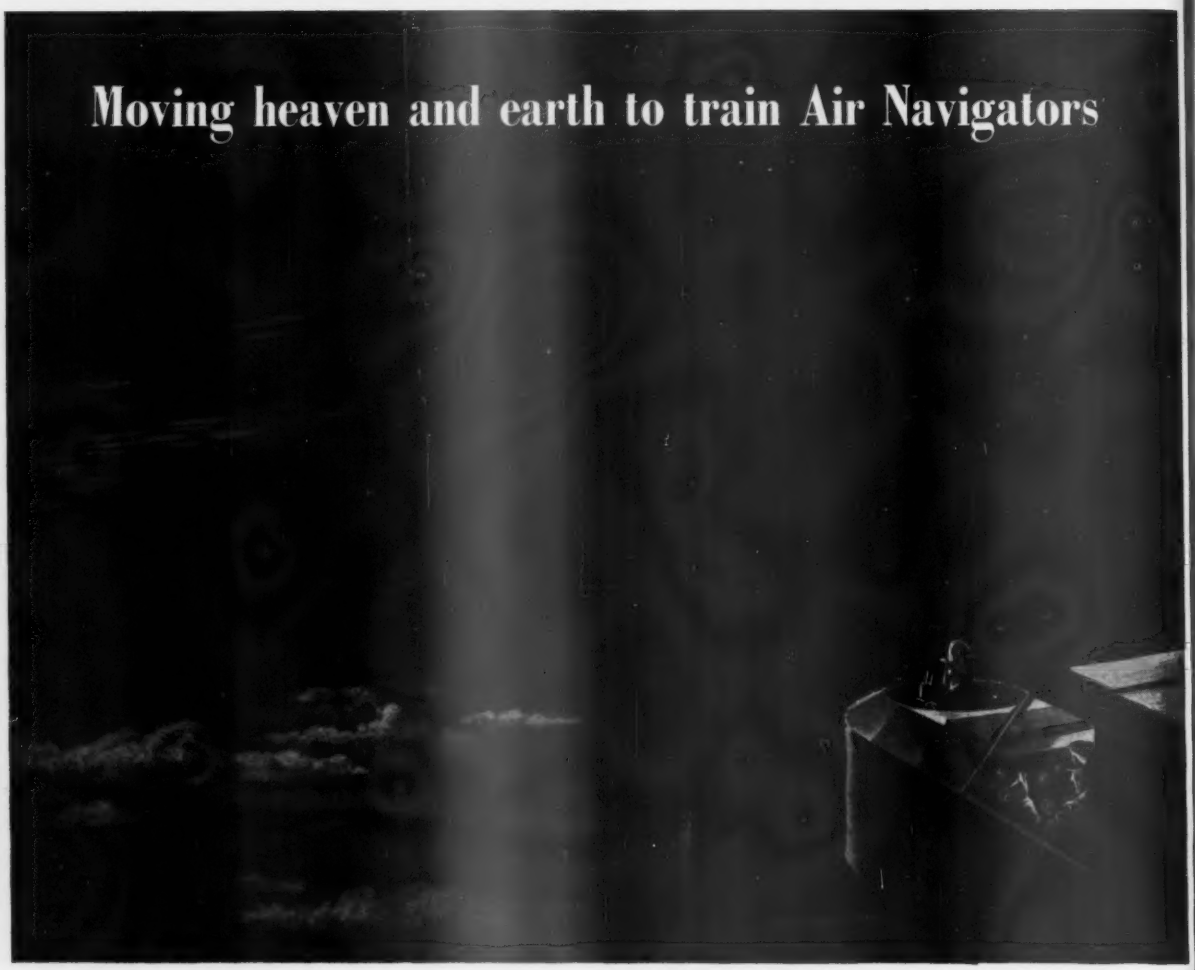

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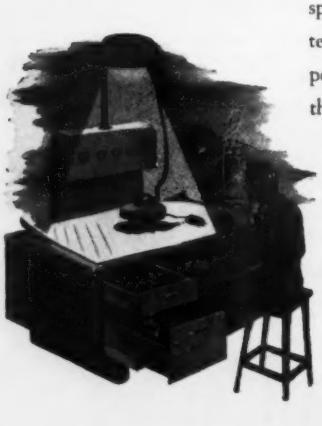

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Effect of Aircraft Operating Characteristics on Airport Runway Patterns

JOHN C. LESLIE,* HAROLD E. GRAY,† AND JOHN J. FORD‡

Pan American Airways, Inc., Atlantic Division

SUMMARY

Part I discusses the effect of allowable beam wind components for take-offs and landings on:

(a) Airport runway patterns, especially the suitability of triangular or 60° patterns.
(b) The requisite length of other runways in relation to the length of the primary runway.
(c) The relative frequency of use of other runways as compared with the primary runway.

Part II presents a novel runway pattern providing certain operating advantages for a large airport designed to accommodate two landings and two take-offs simultaneously.

Harold E. Gray.

John C. Leslie.

John J. Ford.

Part I

RUNWAY LENGTHS AND PATTERNS

THE RUNWAY LENGTH required by large aircraft has steadily increased throughout the years because of the performance characteristics of the aircraft themselves and because of the imposition of safety margins in the event that one engine becomes inoperative during take-off. As a result, it has become increasingly costly and difficult to provide the total ground acreage required, and the cost of paving, lighting, and maintaining these long runways has reached major proportions. As a matter of commonsense economy, therefore, runway lengths and patterns should bear a rational relationship to aircraft operating requirements, just as do load factors in airplane design.

RUNWAY ORIENTATION

The first question that usually arises is how many directions should be covered with a runway. Neglecting special localities, where the wind practically never blows except from one direction or its reciprocal, a choice is usually made between the quadrilateral, or 45° system, and the triangular, or 60° system. In the former case, there are runways in four (or, including the reciprocals, eight) directions; in the latter, there are three (or six) runways. Considering the total cost involved, it would seem extremely important to decide whether the airport designed for present and future, large, multiengined aircraft should use the triangular or the quadrilateral pattern. Our view is that the following analysis supports the triangular pattern.

THE TRIANGULAR PATTERN

The decision depends largely on the amount of beam wind component which present and future aircraft of this category will be able to accept for take-offs and landings. In the case of the triangular system, where each runway is 60° from the next, the maximum velocity of wind which can blow in a direction 30° from each runway and still permit 100 per cent usability of each runway is equal to the maximum allowable beam component divided by the sine of 30°.

If the allowable beam component is 12.5 m.p.h., maximum wind for 100 per cent usability will be 25 m.p.h. If the beam component limitation is 20 m.p.h., maximum wind will be 40 m.p.h., and, if 30 m.p.h., it will be 60 m.p.h. The maximum winds acceptable at a series of angles for five maximum allowable beam components is shown in Table 1.

TABLE 1

Maximum Allowable Beam Component, M.P.H.	Maximum Wind Acceptable at These Angles, M.P.H.					
	90°	75°	60°	45°	30°	15°
12.5	12.5	13.0	14.4	17.7	25.0	48.2
15.0	15.0	15.6	17.3	21.2	30.0	57.9
20.0	20.0	20.7	23.1	28.3	40.0	77.2
25.0	25.0	25.9	28.8	35.4	50.0	96.5
30.0	30.0	31.1	34.6	42.4	60.0	115.8

Presented at the Air Transport Meeting, I.A.S., Washington, D.C., October 26, 1943.

* Manager.
† Chief Pilot.
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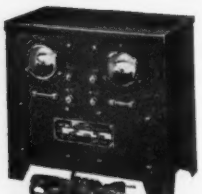

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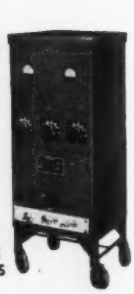

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MALLORY MAGNESIUM COPPER SULPHIDE RECTIFIERS— STATIONARY AND PORTABLE D. C. POWER SUPPLIES— BATTERY CHARGERS AND AVIATION RECTOSTARTERS*

For winds higher than those for 100 per cent usability, the maximum angle of the wind to the runway (θ) will be that angle whose sine equals the maximum allowable beam component divided by the wind velocity. The unusable wind sector between two runways 60° apart would then be equal to $(60° - 2\theta)$ or, for the entire triangular pattern, 6 $(60° - 2\theta)$. Let this angle be called α. Then the percentage of usability for each maximum wind condition will equal $100[1 - (\alpha/360)]$.

If we now assume some certain absolute maximum of probable wind velocity at the airport and if we further make the obviously unrealistic assumption of an equal distribution of velocities below that figure and likewise an equal distribution of wind direction, we can compute frequencies for each 5-m.p.h. interval (Table 2). For example, if the maximum wind is assumed to be 40 m.p.h., the chances of winds blowing from 35 to 40 m.p.h. are 12.5 per cent.

TABLE 2

Maximum Wind	Frequency of Each 5-M.P.H. Interval
30	16.67%
35	14.28%
40	12.50%
45	11.11%
50	10.00%
55	9.09%
60	8.33%
65	7.69%
70	7.15%

By combining these frequencies with the percentage usability for each maximum wind condition, a final average usability of the system will be found for a family of allowable beam wind components. These values are plotted in Fig. 1. This chart shows, for example, that if the maximum wind velocity is 60 m.p.h. and the allowable beam wind component is 15 m.p.h., *the runways will be usable 95.9 per cent of the time.* If the allowable beam wind component is 20 m.p.h., *the runways will be usable 97.2 per cent of the time.* If the beam component is 30 m.p.h., the airport *will be usable 100 per cent of the time.*

Proceeding from an abstract to a realistic distribution of wind velocity, reports from an airport in the New York area over a period of 58 months show the following velocity distributions:

TABLE 3

Wind Range, M.P.H.	Frequency	Cumulative Frequency
0– 5	9.0%	9.0%
5–10	27.2%	36.2%
10–15	21.9%	58.1%
15–20	16.1%	74.2%
20–25	11.9%	86.1%
25–30	8.9%	95.0%
30–35	3.1%	98.1%
35–40	1.0%	99.1%
40–45	0.7%	99.8%
Over 45	0.2%	100.0%

Maximum recorded velocity = 65 m.p.h.

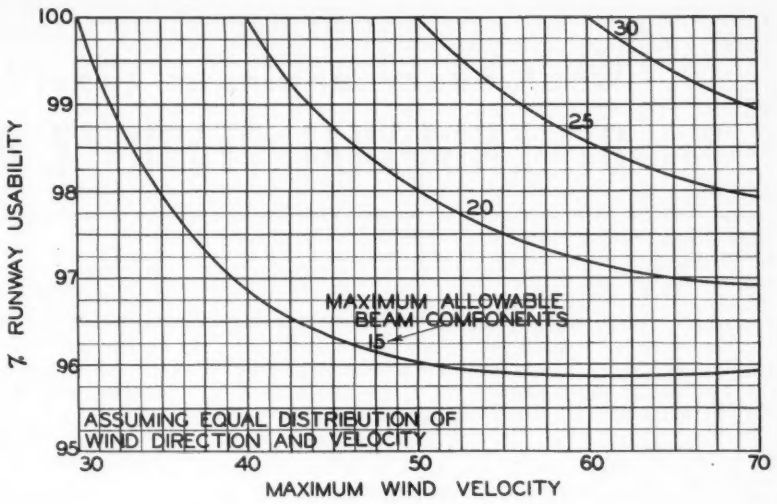

FIG. 1. Usability of triangular runway system.

Using these actual velocity distributions but still assuming equal distribution of wind directions, the usability of a triangular runway pattern, with a maximum allowable beam component of only 20 m.p.h., would be 99.9 per cent. Since prevailing opinion is that future large, multiengined aircraft, using tricycle landing gears, will be able to accept a beam component of at least 20 m.p.h., it would seem clear that the triangular system would be acceptable; correspondingly, it would not seem logical to spend a million dollars or more for the additional runway required by the quadrilateral pattern.

LENGTHS OF PRIMARY AND SECONDARY RUNWAYS

Now the question arises of how long the various runways should be in relation to each other. In past pactice, it has not been uncommon to make them all the same length. But why? Assuming a triangular runway pattern, the primary runway will be used for all winds of such velocity and direction that the component of wind at right angles to the runway is less than the maximum allowable beam component established for the various aircraft involved. Conversely, the two secondary runways will be used only when winds are such that the primary runway cannot be used. The *minimum* wind component parallel to one of the secondary runways, during periods when the primary runway cannot be used, will be:

maximum allowable cross wind component $\times \cos 30°$

Therefore, each of the secondary runways can be shortened to whatever extent the presence of this minimum component blowing along it will shorten the effective runway length required by the aircraft.

Effect of Headwind

Although unanimous opinion does not exist concerning the quantitative effect of headwind component on effective runway length, for illustrative purposes standard textbook wind corrections can be applied to the performance of an actual airplane. A value of permissible reduction is obtained by breaking the total length required into three parts—take-off distance, distance to accelerate to three- (or single-) engined speed, and distance required to clear a 50-ft. obstacle with an engine failure and then computing the wind effect for each condition. In this example, a four-engined transport plane in the 65,000-lb. class was selected. For reduction in take-off distance, the following Douglas Aircraft Company formula is used:

$$R = 1 - [(V_T - V_W)^{1.85}/V_T]$$

where R is the factor by which take-off is reduced, V_T is the take-off speed, and V_W is the wind velocity along the runway. For the distance from take-off to three-engined speed, a constant acceleration is assumed; for climb, a constant air speed. For a maximum allowable beam component of 15 m.p.h., a secondary runway reduction of 15.7 per cent is indicated; for 20 m.p.h., 20.6 per cent. Although the quantitative values may be in doubt, it is not unreasonable to state that some reduction in secondary runway length is justifiable.

FREQUENCY OF RUNWAY USE

From Table 3 it can be seen that for an allowable beam component of 20 m.p.h. *a single runway would suffice 74.2 per cent of the time.* For the triangular pattern, this would mean that each of the secondary runways would be used only 12.9 per cent of the time assuming an equal distribution of wind direction. Judicious placing of the primary runway would further reduce the use of secondary runways. This fact should be considered in planning building and loading ramp layouts, and perhaps some reduction in runway cost may be achieved by building these secondary runways for less intensive use than the primary runway.

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FACTORS AFFECTING DIMENSIONAL STABILITY

	Top Safe Operating Temp., °F.	Heat Distortion Point, °F.	Water Absorption, 24 Hours, %	Coefficient of Expansion Linear per °C. x 10^{-5}	Tendency to Cold Flow	Shrinkage on Aging
RESINOX general purpose molding compounds	275	275	0.50-0.60	3.0-3.5	Negligible	Negligible
RESINOX typical electrical molding compounds	250-300	284	0.07	1.5-2.0	Negligible	Negligible
MELAMINE general purpose molding compounds	250	385	0.45-0.55	——	Negligible	Negligible
MELAMINE Electrical molding compounds	325	266	0.10-0.15	2.0-4.5	Negligible	Negligible
LUSTRON polystyrene molding compounds	160	168-176	0.04-0.06	6-8	Slight to moderate	Negligible
STYRAMIC a modified polystyrene for high frequency insulation	175	184-187	0.046	6-15	Slight to moderate	Negligible
FIBESTOS cellulose acetate molding compounds	140-180	145-260	2.0-4.0	14-16	Slight to marked	Slight to marked
FIBESTOS cellulose acetate sheets	130-150	155-175	1.5-6.0	3-15	Slight to marked	Slight to marked
NITRON cellulose nitrate sheets	130	125-175	0.5-4.0	12-16	Slight to marked	Slight to marked

NOTE: The above values, except where otherwise noted, are determined on samples conditioned and tested at 25°C. (77°F.) and 50% R.H. using standard A.S.T.M. methods. Since wide variations are possible in compounding specific formulations, the values given represent a range.

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There are two general statements that deserve consideration in the orientation of the runway pattern, neglecting possible limitations in the available acreage:

(a) One runway of the system should be in the direction from which the winds of *high* velocity ordinarily blow, in order to raise the per cent-usability of the entire system.

(b) The primary or longest runway should be in the direction from which the winds ordinarily blow under conditions of low visibility, in order that maximum length may be available for instrument approach. For the reasons analyzed above, the longest runway of a multiple runway system should *not* be in the direction of the ordinary prevailing wind, although this has been somewhat common practice in the past.

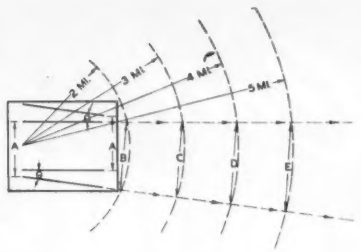
Part II

Increasing Potential Traffic

The foregoing analysis has dealt with the elementary questions of runway orientation and length, assuming only one runway in each chosen direction. A new problem confronts the designer when he finds that one runway will be insufficient to cope with the anticipated volume of aircraft movements. Airports already exist where traffic volume has required the installation of dual runways in each direction. Estimates of traffic potentials for some of our larger cities indicate that transport aircraft arrivals and departures during a peak hour will be so heavy as to demand three landings and three take-offs simultaneously. In the authors' opinion, such intensity of movement would constitute a maximum for a single airport but is nevertheless a highly probable and reasonably obtainable objective. For such intensity of traffic the obvious solution is the "tangential" runway pattern which has been receiving minute and favorable attention. This pattern will not receive further comment herein, except for remarking that the considerations set forth in Part I are applicable.

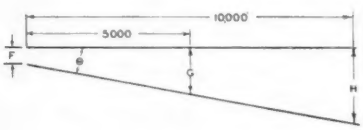
Dual Parallel Runways

If the air traffic volume requires more than one runway in a given direction, present practice is to add a second runway parallel to it, at least 750 ft. away. Opinion is not uniform as to the manner in which these two parallel runways can or should be used. There seems little question that they can be used for one landing and one take-off almost simultaneously. Judged by military standards, they can be used for two take-offs simultaneously, although the authors do not view this as good civil transport practice. Because of air traffic problems during the approach, it would seem that they should not be used for two landings simultaneously, and it is doubtful that by the expedient of dual runways the interval between two landing aircraft can be much shortened as compared with the same two aircraft landing on the same runway. In short, the authors feel that two parallel runways this distance apart can be used for a landing and a take-off almost simultaneously but preferably not otherwise. It is to be observed that the parallel runway system, and any development of it except the "tangential," requires landing aircraft to taxi across the runway used by departing aircraft or vice versa. Outside of the possible hazard involved, the inevitable consequence is some lengthening of the intervals between movements, which means some reduction in airport capacity. The authors see no complete solution for this in any known multiple runway system except the "tangential."



RUNWAY ANGULARITY θ	SEPARATION IN MILES A	B	C	D	E
7½°	100	126	139	152	165
10°	100	135	152	170	187
15°	100	153	179	205	232

Fig. 2. Aircraft separation versus distance from start of take-off.



RUNWAY ANGULARITY θ	SEPARATION IN FEET F	G	H
7½°	500	1160	1820
10°	500	1382	2264
15°	500	1840	3180

Fig. 3. Runway separation versus distance along runway.

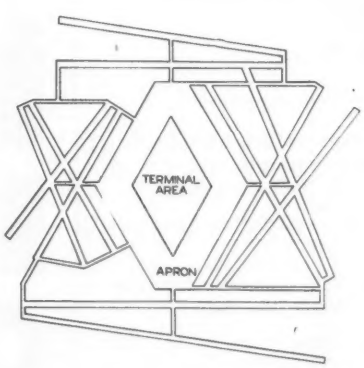


Fig. 4. Triangular runway system for quadruple operation.

Quadruple Parallel Runways

If a still further expansion of air traffic volume is anticipated, the dual parallel system can be doubled thus providing quadruple operation, meaning two landings and two take-offs simultaneously. The authors consider it wholly impractical to accomplish this step by means of more than two runways only 750 or 1,000 ft. apart. On the contrary, the additional set of dual runways should be placed approximately 1 mile from the first set. The seemingly unavoidable conclusion, therefore, is that in any airport providing more than dual operation access to the terminal area must be had by an underground tunnel. Distasteful as this may be financially, the only practical alternative is the construction of a completely new and separate airport for the same city, with attendant disadvantages and costs.

A Modified Parallel System

If the anticipated air traffic volume justifies quadruple operation, meaning two take-offs and two landings almost simultaneously, the authors propose a seemingly novel modification of the "parallel" system. Consider the four runways shown in Fig. 2, which are ordinarily parallel to each other, approximately 750 ft. apart in each set and one set approximately 1 mile distant from and parallel to the other. This means that the two aircraft approaching for a landing are at all times approximately 1 mile from each other and that they are pursuing parallel tracks each toward its own runway. The same statements are conversely true with respect to the two departing aircraft. With regard to two aircraft using one set of runways, one landing and one taking off, the runways they are using are at all points 750 ft. from each other.

As contrasted with the above conditions, it would be desirable if (a) the approaching aircraft pursued converging tracks, meaning that the further they were away from the airport the further apart they would be; (b) the departing aircraft followed diverging tracks for the same reason; and (c) the departing aircraft, as it gained speed on its runway, would increase its lateral separation from the adjacent runway on which another aircraft was landing. This objective can be attained by placing the two runways in each set at a slight angle to each other, shown as θ in Fig. 2. It appears that θ could ordinarily be varied between 7½° and 15°, depending on the particular airport site. For three values of θ, dimensions (D) and (E) show the increasing separation between landing or departing aircraft in relation to their distance away from the center of the airport.

In like fashion, dimensions (G) and (H) on Fig. 3 show the lateral separation between two adjoining runways for three values of θ if the separation at the narrow end is assumed to be 500 ft.—a figure we believe to be satisfactory in the light of present practice.

(*Continued on page 19*)

"Heli-Coil" SCREW THREAD INSERTS

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THE NEW WIRE INSERT

The "Heli-Coil" Bushing of stainless steel or phosphor bronze wire engages screw threads of the American National System. Protects tapped threads in light metals and plastics against abrasion, seizing or galling.

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"Heli-Coil" Inserts provide a quick, simple and inexpensive method of protecting tapped threads in aluminum, magnesium and other materials, against abrasion, stripping, seizing or galling. They also render important service in salvaging parts containing tapped threads that have stripped or worn oversize.

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Some Design Aspects of the Air Cargo Problem

E. A. PETERMAN*

Army Air Forces Matériel Command

Lt. Col. E. A. Peterman.

Packaging Air Cargo

It is essential that air cargo be secured properly in the transport airplane not only to assure safe delivery of the material but also to prevent possible damage to, or even loss of the airplane. The problem of packing, handling, and shipping air cargo is peculiar in several important respects. The most important consideration is weight. Obviously, any additional weight required for packing and handling reduces by that amount the cargo material, in weight, which can be carried. It is provident, therefore, to keep the additional weight to a minimum and yet there must be a sufficient amount to allow adequate performance of the job. Experience to date indicates that packaging in medium sizes is most economical. A 70-lb. package can be handled by one man and, with presently developed packaging materials and methods, can be more economically packaged than large weight items or a number of small items individually packaged.

The present air cargo packaging materials in the apparent order of preference are: (1) corrugated cardboard cartons, (2) reinforced fiberboard, (3) cleated plywood, (4) wirebound boxes, (5) canvas bundles, and (6) nailed wood crates.

The problem of economically packaging Air Cargo is now undergoing intensive study by Army and Navy personnel.

* Lieutenant Colonel, Technical Staff, Engineering Division.

Main Floor Tie-Down Fittings

With regard to tie-down fittings in the transport airplane, experience to date has brought forth certain criteria that may be useful for design. Commercial packages handled by Express average approximately 13 lbs. per cu.ft. A year or so ago, it was 7 to 9 lbs. per cu.ft. The trend appears to be toward increasing density. Military packages average about 18 lbs. per cu.ft., and hardware items average about 40 lbs. per cu.ft. Therefore, to take care of future contingencies, the designer might reasonably assume 40 lbs. per cu.ft. as a design criterion. Experience indicates that stacking packages up to a height of about 5 ft. is reasonable, but higher than that is not practical. A stack of five "1-cu.ft." packages would therefore weight 200 lbs. and this gives a local floor loading (static) of 200 lbs. per sq.ft. With a down-load factor of 5.0, the ultimate loading on the floor is 1,000 lbs. per sq.ft. Floors designed for much less load than this are apt to be springy.

Spacing of Fittings

Personnel experienced in handling air cargo have indicated that the spacing of tie-down fittings should be uniform and that a close spacing is desirable. If a spacing of 2 ft. between centers is assumed, then it may be seen that 4 sq.ft. of floor area is allotted to each tie-down or (4 times 200 lbs.) 800 lbs. per fitting applied normal to the floor. Taking into account the fact that not every square foot of floor will be so loaded simultaneously, and with the support afforded by the other tie-downs not otherwise in use, it is expected that the probable up load due to the airplane encountering a gust, for instance, will be not greater than 1,000 lbs. per tie-down. Therefore, on this spacing, an arbitrarily assumed up load of 1,000 lbs. per fitting appears reasonable, and this also should be satisfactory for "handling" loads, provided a lateral load parallel to the floor is simultaneously applied. This lateral load is to take care of tipping or overturning of the package. The center of gravity being assumed half way up the package, the lateral load obviously should be one-half the vertical load or 500 lbs. per fitting. It is assumed that the friction between package and floor under pressure of the tie-down rope in tension or the weight of the package adds sufficient resistance to overcome the side or fore and aft (shear) loads due to accelerations in take-off, landing, and bumpy air.

Brig. Gen. F. O. Carroll, Chief, Engineering Division.

If a spacing of 3 ft. between centers is assumed, then it may be seen that 9 sq.ft. of floor area is alloted to each tie-down (9 times 200 lbs.) or 1,800 lbs. per fitting. This higher concentrated load is more difficult for the designer to handle and does not comply with the operator's desire for close spacing. The 2-ft. spacing appears to be about right but, if made arbitrary, may cause difficulty for designers who, for instance, have used a 20-in. bulkhead spacing in the fuselage. A study of bulkhead ring spacing used in current airplane designs shows that a tie-down fitting spacing that is uniform and is 22 in. ± 3 in. will give satisfactory results.

Side-Wall Fittings

The above discussion pertains to main floor tie-down fittings only. Experience in the field indicates that a row of fittings should also be provided on each side wall and that these fittings must be of equivalent strength to the main floor tie-down fittings. Safety belt fittings may be designed accordingly and thus made to serve a dual purpose.

For the smaller auxiliary compartments, such as under the floor where space prevents heavy loading, smaller tie-down fittings might be used. As-

(*Continued on page 139*)

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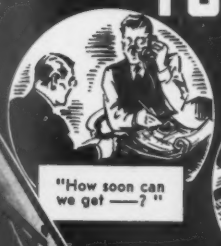
An Instrument Littelfuse (actual size) showing "Locked Cap" assembly and Bridge Construction.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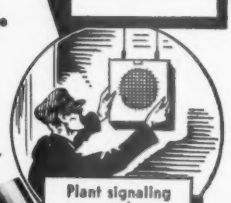
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Intercontinental Flying and the Pilot*

ROBERT N. BUCK†

Transcontinental & Western Air, Inc.

THE PILOT is primarily interested in getting his flight through to its destination safely. Of secondary interest is the arrival on schedule.

The problems that confront a pilot are much the same whether the flight is from New York to London or New York to Pittsburgh. The same factors enter the question, with the exception that some enlarge or diminish with distance, terrain, and weather. Since an airplane's natural domain is the air it does not matter much what is under the airplane. For this reason an Air Transport pilot's training can be fairly well standardized. The aids necessary to safe flight can be standardized also.

In our present-day flying over the globe we find aids to navigation that are the same as, and a direct transformation of, the aids that we have on any of our airways in the United States. The airplanes, except for size and small improvements, are the same.

PROBLEMS OF THE PILOT

When it came time for the air-line pilot to fly intercontinentally he simply had to take his usual problems and apply them to longer flights in foreign lands. It is true, of course, that the original efforts made by the air-line pilots in the early stages of the war had an extra element of hazard because of a lack of radio aids, overloading equipment, fields under construction and so on, but basically he had the same problems: weather, proper functioning of equipment, and traffic.

These main factors subdivide into a multitude of smaller ones that intermingle and, at times, make a complicated puzzle. The pilot must decide whether the flight can be made safely, and then he must fly it. This can best be demonstrated by giving a few concrete examples of flights that were both canceled and completed and the reasons, with thoughts as to how these flights might have been completed or better managed.

FLIGHT "A"

Flight "A" was one of 2,000 miles. Because of national security the names of the places cannot be told. It was near a war zone, and, because of this, accurate navigation was necessary. It was impossible to use radio signals for reasons of safety. A deep low-pressure area was directly in the flight path and it was necessary to go through this system.

Fuel Reserve

The flight was delayed for the following reasons: (1) Because of the load to be carried, the fuel reserve was small. This meant that it would be necessary to know the ground speed accurately in order to ascertain whether the flight could be completed before the point of "no return" was reached. (2) With the type of weather involved, it would be impossible to get on top and obtain celestial fixes. With these uncertainties it was not wise to take off.

Let us review this attempt and decide what mechanical aids or general improvements could have made this flight possible. First, of course, would be enough fuel to insure sufficient range even with winds of greater force than normally found in a cyclone of the type necessary to fly through. To have this much fuel is, of course, economically unsound. If the airplane had sufficient ceiling and was pressurized, it could have been flown on top of all clouds and thus obtained accurate celestial fixes.

In peacetime, radio would have been used either with bearings given to the airplane or bearings taken from the airplane on reliable stations. Also in peacetime, the flight could have operated with a track that would have taken it around the low-pressure area in such a way as to take advantage of the winds in the system. Unfortunately, in this case a track of this type would have resulted in flight over enemy territory.

FLIGHT "B"

Flight "B" was westbound across the North Atlantic. The weather was such that various cloud decks existed in the early part of the flight. The uppermost of these decks was too high to top, but a sufficient ceiling existed under the lowest deck to fly below it. On the western side of the ocean a cold front existed with above-freezing temperatures in advance and below-freezing temperatures behind the front. It was determined that the tops, behind the front, would be within range of the airplane. The pilot realized that the airplane would be comparatively light by the time the front was encountered and therefore would be in a good position for a rapid climb. It was decided to operate the flight. It was made at low levels using dead-reckoning and drift sights until the front was encountered. Then the flight proceeded on instruments until the icing level lowered too near the surface for flight under it. Here the pilot made an immediate climb and eventually broke out on top of all clouds at 18,000 ft. Light icing was encountered in the climb but the deicer equipment was able to take care of it.

The Icing Hazard

This flight was mostly based on the idea that it would be possible to top the clouds when the icing hazard existed. This could be counted upon since enough meteorologic information was available to be sure about the cloud tops. However, had this information not been available, the flight would have had to be held or have enough fuel to go to the front and return to the original point of departure in case the tops were too high and the ice heavy.

Since our present deicing equipment is insufficient in prolonged instrument flight in icing conditions, the mechanical solution to make a flight of this type possible at any time would be a deicing system that could function efficiently in any type of ice.

FLIGHT "C"

Flight "C" was a flight from New York to Pittsburgh with conditions such that Pittsburgh's ceiling was 500 ft. and the visibility 1 mile, with freezing drizzle and heavy icing conditions to 9,500 ft. It was necessary for this flight to proceed beyond Pittsburgh because of the hazard in descending through such icing and making an instrument letdown in those conditions. It is not safe to depend on present ice-removing equipment for a descent of the type mentioned. Together with the hazard

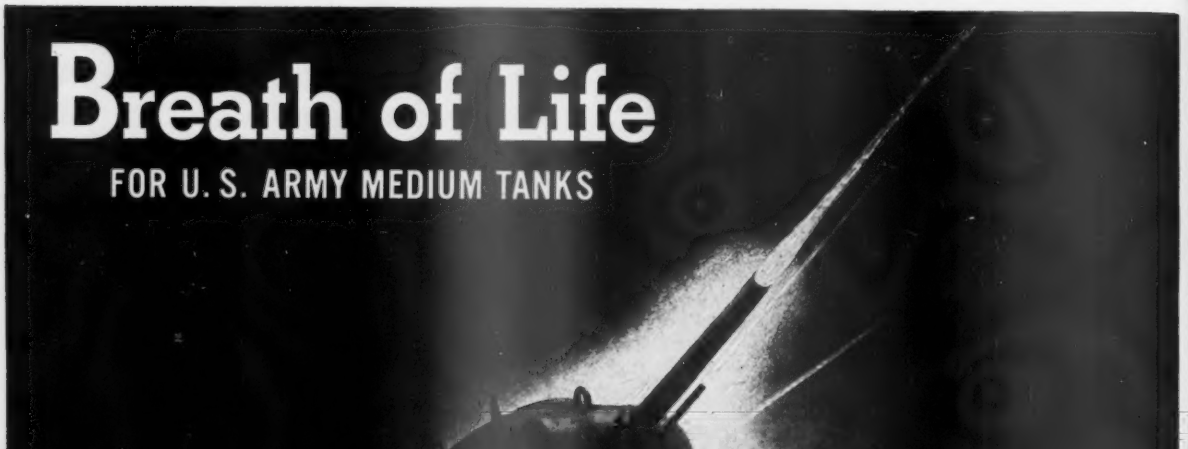
Presented at the Air Transport Meeting, I.A.S., Washington, D.C., October 26, 1943.

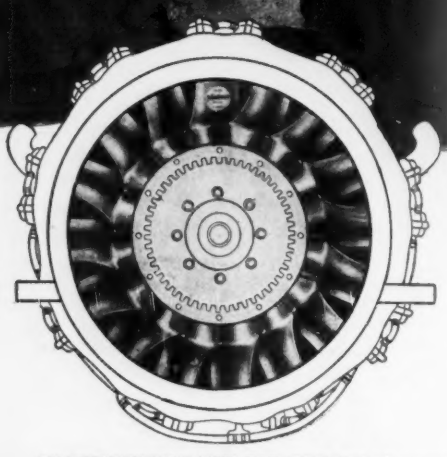
* The views expressed here are those of a pilot and do not necessarily constitute policies or ideas of Transcontinental and Western Air or the Airline Pilots Association.

† Pilot Captain.

Breath of Life

FOR U. S. ARMY MEDIUM TANKS





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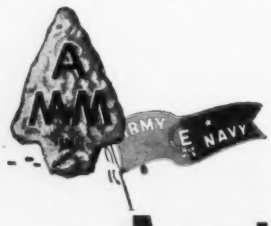

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of a heavy ice load, the pilot would be faced with inadequate visibility through the cockpit windows should he arrive in a position to make a landing.

To make this flight a possibility, a better ice-removing system, as mentioned before, and a more positive method of keeping the windshield clear under all conditions are needed. It is true that advances have been made in windshield clearance, but in cases of heavy icing the pilot generally has only a small clear space on the window to see through and must land with restricted visibility. Often it is a matter of landing with an open windshield and being exposed to the elements with the possibility of eye damage.

The addition in recent years of the windshield wiper is a great help to the pilot; visibility, through rain, which is 1/2 mile suddenly becomes 3 or 4 miles when the wiper is turned on. While this is a tremendous improvement the pilot looks for further improvement.

Efficiency in visibility through the windshield is a factor that enters a pilot's mind when he is deciding whether or not to delay a flight, because he realizes, as he visualizes the flight in question, that a forecasted ceiling of 500 ft. and 1 mile visibility with moderate to heavy rain willl be, from the pilot's chair, 500 ft. and 1/4 mi.

Flight "D"

Flight "D" was to a foreign island. The forecast ceiling and visibility was 300 to 500 ft. and 1/2 to 1 mile. Three hundred feet was below safe minimums and 500 ft. barely within the limits. Because of load and distance to an alternate, the flight was delayed.

This type is one of the most common. First, it cannot be definitely counted upon in meteorologic science to say whether a ceiling will be 300 ft., which is outside limits, or 200 ft. higher (500 ft.), which is within limits. Second, if there are no alternate airports available, the flight could not depart even if the ceiling should definitely stay at 500 ft. Also, if the ceiling were definitely 300 ft. or lower, the flight could not be considered.

Boeing Stratoliner—now flying in Army Air Transport Command.

Instrument Landing

Planes are delayed or must carry extra fuel, which means a reduction in pay load, because of a low ceiling all over the world. The solution seems to be a blind landing system. This certainly is within the realm of possibilities, since the author flew such a system 4 years ago. But should the times prevent placing such systems in operation, certainly improvements could be made in our present installations which would make it safe for ceiling and visibility limits to be lowered considerably.

There is a little problem, to the pilot, in making an instrument approach. If there is a radio range available, he can follow it and let down to any figure desired or allowed by safety on the altimeter. The pilot's greatest difficulty in bad weather approaches occurs after he breaks out of the clouds and approaches the airport. Then he must find the runway, keep it in sight, and land on it. In rain, snow, or reduced visibility with perhaps ice on the windshield, it is an interesting procedure to find the field and get on it. If a radio-range leg lies down the runway to be used, the problem is tremendously simplified. Even though the pilot can just see straight down he need only stay on the range leg until the field comes in view or he has passed a certain time limit over which it is unsafe to proceed at the low altitude.

However, even with a range leg lying down the runway, it is at times difficult to make a landing. If the visibility is poor, the pilot dares not lower the plane below the minimum safe altitude of approximately 500 ft. until the field is in view. If the field suddenly comes into view almost directly under the plane, the pilot is unable to land because he is too high. This means he must circle the field. With such reduced visibility he will have a difficult time finding the field again.

If there existed a radio-range leg, localizer, or any other directional aid down the runway to be used and, in addition, two markers on that leg, the pilot would be able to land with poor visibility and much lower ceilings than at present. He could let down to one altitude on the first marker and then cross the second marker near the edge of the field—for example, at only 100 or 200 ft.—and then let down almost to the runway.

In this way, without a so-called blind landing system, it would be possible, with equipment developed, to reduce our present weather minimums or to complete more flights even at the present minimums.

Experimental plane used by D. W. Tomlinson.

Flight "E"

There are many personal factors that enter a pilot's decisions. Flight "E" is an example of one of these. The flight involved—a night flight of 1,100 miles with five stops—was within the United

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States. It was operated between the hours of 9 p.m. and 6 a.m. The weather was such that an instrument approach was necessary at each station. The air was turbulent and icing conditions existed that required letting down through ice at each station.

The flight was operated within all the rules and regulations and the pilot and copilot had had a sufficient legal rest period. Unfortunately, because of the shortage of hotel accommodations, the pilot had been obliged to stay in a noisy downtown hotel and was unable to obtain proper sleep before the flight.

The flight was made through to the last leg. At this point the pilot held the flight. Although the weather was poor ahead, the pilot knew it was flyable, but, because of the past four instrument approaches under difficult conditions and little rest, the pilot felt he was in such a state of fatigue that it was not wise to continue. Consequently, although the weather was a large factor in holding the flight, fatigue, recognized by the pilot, was the major factor.

As stated, this flight was within all legal bounds. Had the pilot continued and possibly ground-looped or damaged the airplane on the last landing, he probably would have been blamed for the accident because of some error in technique. If he had stated that he was tired out and not on his toes, it would have been a poor excuse because legally he was not tired.

Rules and Regulations

Perhaps there is room for improvement in the rules and regulations that guide a pilot. There is certainly a place for other medical practices that will discover fatigue or physiologic reactions that affect a pilot's flying. Although by our present medical flying standards a pilot must be a near-perfect physical specimen, it certainly takes little actual physical power or bombastic robustness to sit in a comfortable chair and move a few levers that are generally easy to move.

Flight "F"

Flight "F" was a simple westbound North Atlantic crossing but with head winds that made the crossing impossible unless the greater portion of the cargo was removed.

This, of course, amounts to a balance of economic factors. The pilot can make the trip with little cargo if that cargo is important enough to warrant the flight even though the pay load is small. But in peacetime, when an air line must attempt to earn a profit, the flight would have to be held.

The solution to this is gradual and the pilot looks to airplanes with greater load and greater range as time progresses. Certainly, the engineering abilities of our industry have already shown it will come to pass.

Flight "G"

Flight "G" is a type that happens in the United States with its busy airways. It has begun to happen in foreign countries and will occur more often in the future.

The flight was cleared from New York to Chicago, with the Chicago weather 600 ft. and 1 mile. A suitable alternate was available. Upon arrival at Chicago the pilot was informed he was No. 6 to approach and was given an expected approach time. This approach time was such that in order to fly and hold awaiting final clearance the pilot would use his reserve fuel. If the pilot held and awaited his approach time, in this case, he would be unable to reach his alternate in the event the Chicago weather should suddenly go below landing limits. Therefore, upon being given the lengthy approach time, the pilot was forced to proceed to his alternate even though the Chicago weather was above landing limits.

Necessity for Adequate Communications

This is a common case and one that looms in the future as tremendous. It is indeed difficult to solve, but at first glance it appears that communications slow the present traffic procedures. Too much time is lost between the time the traffic controller originates a message and the time a pilot receives it. Part of this is because of lengthy conversation procedure.

All in all the traffic control methods now in use, while efficient, will certainly reach a saturation point with any appreciable traffic increase. It had almost reached this peak at the beginning of hostilities, and many flights then had to be diverted, held, or canceled because of a pilot's being informed he was No. 14 to land.

Weather Problems

A constant source of trouble is the thunderstorm. There are different types that must be flown in different manners. They divide into two groups: the air-mass thunderstorm and the frontal thunderstorm. In the case of the air-mass type the pilot can generally fly around them and thus avoid the storm center. But the frontal type covers a large area that cannot be flown around except on long flights.

While flights have been made through thunderstorms, it is an undesirable practice and certainly a hazardous one, especially on long flights with an airplane that is overloaded to such an extent that its structural strength is a factor.

It is not generally possible to top these conditions. In the future we may have airplanes that will be quite able to top all clouds, and this will be a great boon to the long-distance flight, but the local feeder-type operation will continue to suffer the turbulence, static, and reduced visibility.

Radio Reception

One definite help to the local flight that must fly thunderstorms would be radio reception at all times. It often happens that the plane is being flown on instruments near a thunderstorm but the pilot cannot read two-way plane to ground radio or the radio range because of severe static as a result of the near-by thunderstorm. Actually, in a storm, all radio signals cease and the static blots out any directional aid. If a thunderstorm is encountered, a pilot simply holds a constant heading and hopes that when he comes out on the other side he will be somewhere near his intended track. Thus, even though thunderstorms cannot be flown as a regular practice, a general improvement of the situation would be static-free radio at all times.

Conclusion

The pilot is faced with the same problems he has had in the past and he is faced with them wherever airplanes are flown. These problems have been made somewhat smaller because of developments in all fields of aviation and by the pilot adapting himself to the new developments.

The man who flies the airplane is simply one of the parts of the whole we call "air transportation." But his interests and economic life depend on the success of air transportation. The great problem that presents itself, before complete economic stabilization and the rosy picture of a flying world can exist, is the one of being able to maintain a schedule 365 days a year regardless of wind or weather. At least, so it appears from the cockpit.

(*Continued from page 11*)

Although many variations are possible in this "double-Vee modification of the quadruple, parallel plan both in its layout and in its use, there are certain elements of symmetry which can be noted. It is self-evident that the apex of one set of runways is at the opposite end of the field from the apex of the companion set. Furthermore, if each set is related to the other, as shown in Fig. 4, it will be seen that the right-hand runway of each set could always be used for taking off while the left-hand would be used for landing, thus providing the pilots with a fixed procedure.

Whether or not this "double-Vee" runway will ever be incorporated in an actual airport design remains to be seen, but in any event it is founded upon and reveals certain elements of aircraft operating characteristics, including air traffic problems, which seem to merit recognition in the laying out of airport runway patterns.

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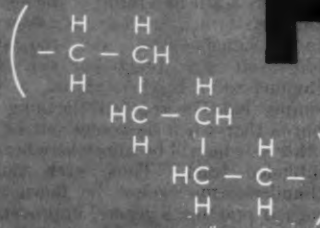

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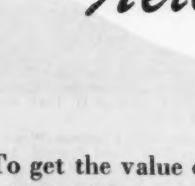
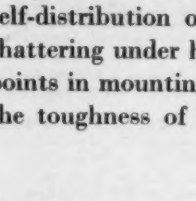
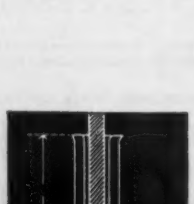


2. CHANNEL DEPTH—Assume the airplane window will be exposed to temperatures from –70° F. to 140° F. and humidities from 0% to 100%, then make full allowance for expansion and contraction by proper choice of channel depth and sheet size. (See Lumarith Mounting Book, 2nd Edition for formula.)



3. BOLT HOLES—Don't spoil your mounting with tight bolt holes. Before specifying size of bolt holes, distance from the edge and the spacing, see results of tests, given in Lumarith Mounting Book, 2nd Edition. (These tests cover various combinations of the three factors.)



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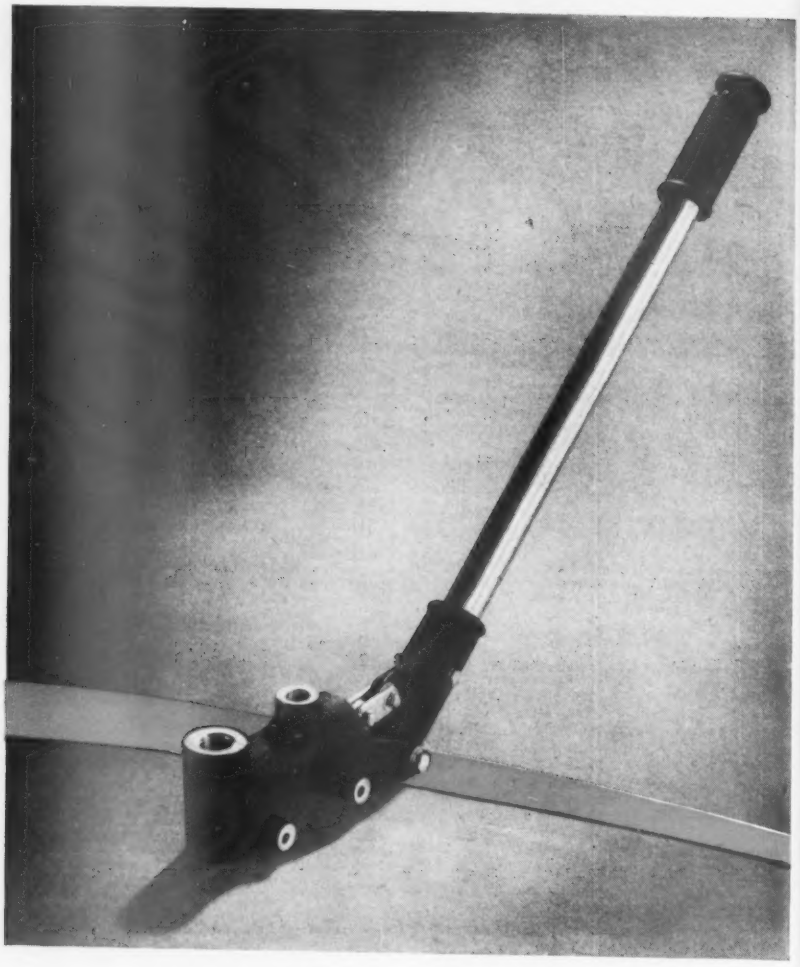

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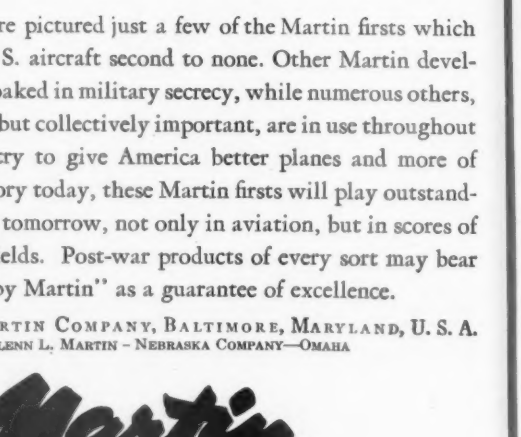

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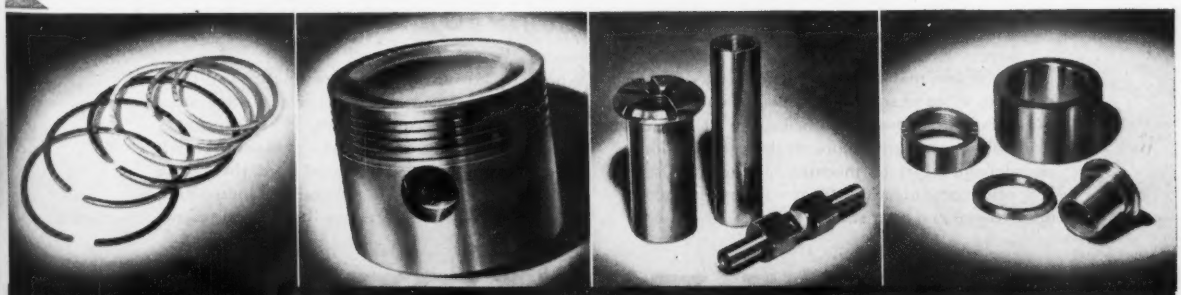

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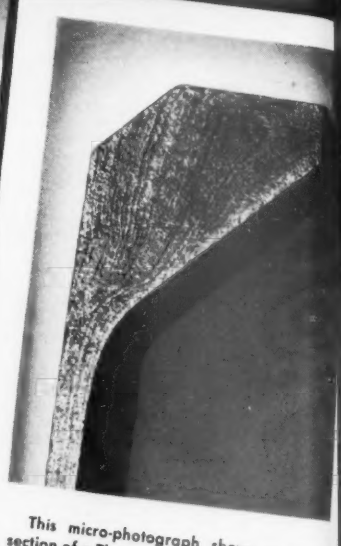

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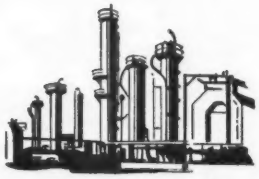

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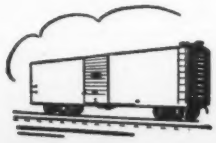

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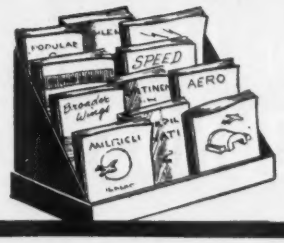

Periodicals

Accessories

High-Voltage-Ignition-Cable Design for Aircraft. H. H. Wermine. Problems that must be met in the design and insulation of aircraft ignition cable are discussed. Both mechanical and chemical problems must be considered. It is essential to know the conditions of usage. Chemical, electrical, and mechanical conditions that may have to be met in the insulation of aircraft ignition cable are listed. It is pointed out that high-altitude flying has greatly complicated the problem of designing satisfactory aircraft ignition cables. The present trend in specification writing is to emphasize performance tests rather than constructional details or requirements based on specific materials.

Information is given in tabular form on the characteristics of different insulations and protective coverings and on the relative merits of different types of cables. Graphs show heat, atmospheric pressure, and voltage conditions during a "simulated flight test." *Electrical Engineering*, November, 1943, pages 716–719 (Transactions), 5 illus.

Aerodynamics

The Lateral Stability of Aeroplanes. H. L. Price. Part IV of a series of articles on a new geometric system for determining the lateral stability of aircraft. Numerical results of the study are reproduced in 24 charts. General considerations regarding the effects of flaps, propellers, and engine power are discussed. *Aircraft Engineering*, October, 1943, pages 281–287, 27 illus.

Performance Calculations. Max M. Munk. The relationship of drag to airplane performance is studied in the light of a summary performance computation method established by the writer some time ago. The basic drag equation and the basic power equation are demonstrated, with emphasis on their simplicity and applicability to the problems involved. A flight condition is selected under which, with constant power and minimum drag, the lowest fuel consumption per mile and the most economical cruising velocity are obtained. These factors are then analyzed. Mathematical computations are discussed for determining the maximum level velocity and the maximum rate of climb factor, as well as a variety of other problems. Comments are made on methods developed by other aerodynamic scientists. *Aero Digest*, November, 1943, pages 160, 162, 304, 1 illus.

Calculation of Wing Profile Drag. Maurice Holt. A modification of the method of Squire and Young, developed for calculating wing-profile drag solely from the knowledge of the geometry of the wing section, is introduced in order to simplify the calculations involved. The method of Squire and Young requires the distribution of the skin friction in the turbulent region of the aerofoil surface. This distribution was determined by using von Kármán's logarithmic flat plate relationship and required a somewhat laborious numerical integration of a differential equation. In this paper Falkner's new power index law for the skin friction coefficient of a flat plate with fully turbulent boundary layer is used instead of von Kármán's law, and it is found that the resulting differential equation for the skin friction is directly integrable.

The simplified method is applied to determine the profile drag of the NACA 2414 section, and the results are compared with those derived by the original method. *Aircraft Engineering*, October, 1943, pages 278–280, 2 illus.

Air Cargo

Packaging for the Armed Forces. David Goodman. Developments in the field of packaging are exemplified by descriptions of leading exhibits at two packaging expositions: one given by the Philadelphia Ordnance District in Philadelphia; the other by the armed forces at the convention of the Technical Association of the Pulp and Paper Industry in Chicago. Although these developments are not solely applicable to air transportation, in almost all cases they are suitable for and facilitate shipment by plane. Among the products and methods noted are: No-oxid, a Dearborn Chemical Company product for use as a moisture-barrier wrapper or film; a plastic coating made by the United Shoe Machinery Corporation for outer covering of metallic equipment; a method of rust prevention sponsored by the Tainton Laboratories, which involves the use of 99.5 per cent pure

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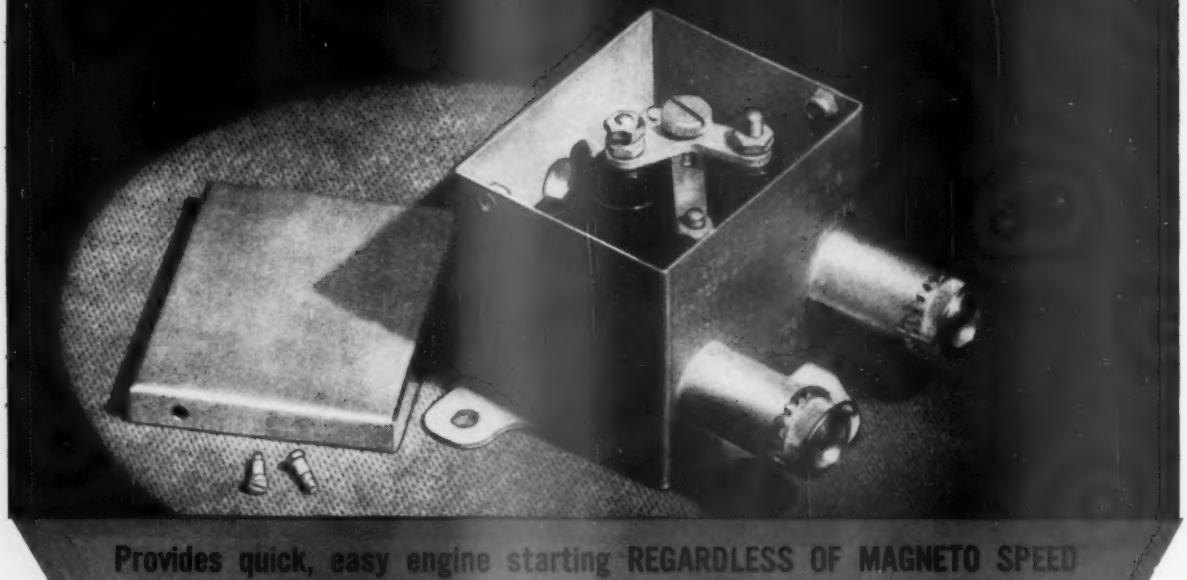

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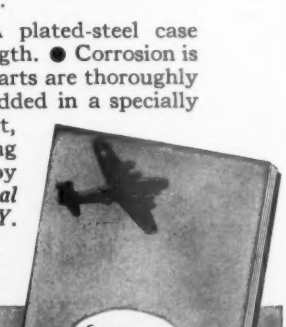

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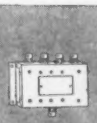

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GENERAL ELECTRIC

zinc to prevent the electrolytic action accompanying corrosion; the VIM fiber box exhibited by the Marine Corps; adaptations of the lead-foil bags produced by Reynolds Metals Company; Dow Chemical Company's Saran film and du Pont's cellophane-cellulose film (both are compared with Goodyear's pliofilm); and a six-ply moisture-barrier material devised by Thomas M. Royal Company. Also included in the descriptions are details on the flotation of delicate equipment within containers, as displayed by the Naval Bureau of Ships; a vinyl-coated bag with cloth side out, developed for the Naval Bureau of Supplies and Accounts; Buick Motor Division's methods of packing cylinder heads; and the knockdown wooden box for packing engines, used by Chevrolet. *Flying*, December, 1943, pages 5–7, 31, 32 (Air Commerce Department), 6 illus.

A Gardenia or a Jeep. Edward S. Evans. The President of the Evans Products Company describes some methods of securing cargo in airplanes. These include ways of eliminating slack from tying equipment and several rod, beam, and hook devices for preventing loads from shifting. He also mentions the Evans Foundation for Air Cargo Research now under way at Wayne University in Detroit. Analyzing the traffic currently handled by Railway Express, box car load, less-than-carload railway freight, motor truck, and water, the purpose of the Wayne University study will be to determine which commodities will economicaly and beneficially be carried by air transportation. Its approach will be as a market survey from the shippers' standpoint. *Midwest Aviation and Yachting*, November, 1943, pages 13, 23, 26, 5 illus.

Deficiencies of Converted Passenger Airplanes for Cargo Transport and Operating Requirements. Charles Froesch. It is stated that ten shortcomings of the converted passenger plane are: (1) floor slope and irregularity of floor at door causing concentration of load at that point; (2) floors too weak, requiring reinforcing; (3) doors too narrow for entrance of bulky loads; (4) no anchorage for load fasteners; (5) no provisions for cargo handler station; (6) hard-to-distribute load so as to give a satisfactory center-of-gravity location; (7) lavatory in the wrong place; (8) insufficient fire extinguisher protection; (9) door-sill heights too variable; and (10) circular or oval fuselage shape, which cannot be used effectively.

The problem of getting the rate down to the point where repeated business will follow is discussed. It is stated that the size and capacity of the cargo plane cannot be predicted until a thorough analysis of the air express and freight market has been made.

The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.

It is stated that a density-volume ratio of 8 to 9 lbs. per cu.ft. can be used as a design criterion in figuring size of compartment. The airplane should also be designed so that preventive maintenance and service methods can be best applied. *S.A.E. Journal*, December, 1943, pages 432–438 (Transactions), 11 illus.

Air Power

Frenzied Axis Air Defense No Match for Allied Power. A review and analysis of the war news which indicates the steadily mounting superiority of Allied air power. Methods of aerial combat, equipment, production, and war gains which have contributed to the Allies' stronger position are examined. New developments in Axis equipment and tactics are also reported. Among the more specific points covered are: the increased bombing of Germany; the paralysis of 30 per cent of German industry at a loss of only 5 per cent to Allied air raiders; the replenishment rate of Allied to German aircraft at a claimed ratio of 4 to 1; the slow but gradual advancement in the South Pacific; the replacement of the battleship by the aircraft carrier as the U.S. Navy's capital ship; the weakening of the Fortress Europe; and the planning of larger bombers for the Allies. A box score of American combat aircraft gives the loss ratio of enemy and American planes during actions from December 7, 1941, to September 1, 1943, listing the name and location of the air force and the types of American planes involved. *Aero Digest*, November, 1943, pages 116–121, 313–316, 10 illus.

Pacific Enigma. Leonard Engel. A discussion of air combat operations during the past summer in the South Pacific, in which the writer refutes the belief that Japan's air power is declining. According to his calculations, the Japanese are losing about 700 planes a month while they are producing a minimum of 800 a month. The changeover of Japanese air activities from the offensive to the defensive in all South Pacific sectors except China is attributed to the reinforcement of Allied strength rather than to any disintegration of Nipponese air power. The article includes an estimate of the number of Japanese aircraft carriers and a brief description of the new Japanese plane, Type 3, introduced in the northern Solomons. *Air News*, October, 1943, pages 24, 25, 56, 8 illus.

The Dutch are Coming Back—Flying. An account of the current flying activities of the Dutch. The article mentions the Royal Dutch Naval Service and Dutch fliers under the Royal Air Force standard and then in greater detail describes the work that is being carried on by a Dutch auxiliary squadron in MacArthur's Pacific air forces, the Royal Netherlands Military Flying School at Jackson, Miss., the Royal Dutch Airlines, and the Royal Netherlands East Indies Line. Plans for the resumption and expansion of Dutch air routes after the war are noted. *Aero Digest*, November, 1943, pages 122–124, 287, 288, 8 illus.

Air Warfare Review. Hanson Baldwin. Continuation of the writer's monthly analyses of war news. Leading up to the climax that Allied air strength is being put on the alert for a land invasion of western Europe, he summarizes the course of the air war during the fall and early winter of 1943 with regard to the air blitz against Germany and German-occupied countries, the war against the submarine, Sicily and Italy, the New Guinea campaign, Alaska, the Central Pacific, China and India and shifts in American air commands.

Weather and new weapons are discussed as two factors that particularly influenced the trends of air combat. Because of winter weather conditions, it is reported that the number of daylight, precision-bombing attacks in western Europe will diminish and a large proportion of American bomber strength will be diverted to night or area operations. The modifications necessary for adapting American airplanes to this type of operation are reviewed.

Increasing effectiveness of German defense is indicated by a number of new devices that the enemy has begun to introduce. Those noted include a rocket "gun," a type of rocket bomb, and an adaptation of the robot plane. *Skyways*, December, 1943, pages 28, 29, 88, 100, 4 illus.

Air Battle Formulae. John Yoxall. From a visit to the Mediterranean theater of operations, the writer records his impressions of the role played by air power in the conquest of this area, the present air position of the Allies, and the significance of Mediterranean control to further air strategy. He reports that complete air mastery has been established by the Allied Mediterranean Command. In a commentary upon the coordination of land, sea, and air forces, he indicates air power to be the dominant factor. Among the more specific

operations discussed are: the use of air bombing to destroy aircraft on the ground; the moving of air bases; the organization and methods of the Army Air Forces' scheme for handling tactical targets and "targets of opportunity"; the replacement of airplane recognition by gun discipline when air supremacy had been established; the support work of Kitty-bombers and Invaders; the destruction of the enemy's fuel and oil replacements; and the continual air-sea war carried on by the Mediterranean Coastal Command. *Flight*, October 21, 1943, pages 441–446, 10 illus.

People and Planes. John Yoxall. Second of a series of articles on the Mediterranean air war. This one is concerned generally with depicting the spirit and high morale of the Allied air personnel on this front. More specifically, it is devoted to an account of the officers in charge of the campaign and the airplanes that are employed. The cooperation and dove-tailing of American and English forces is stressed. Among the personalities mentioned are Generals Eisenhower and Spaatz, Air Chief Marshal Tedder, Air Marshal Coningham, and Air Vice Marshals Broadhurst and Lloyd; among the planes are the Spitfires, Marauders, Fortresses, Beaufighters, Lightnings, Dakotas, Kitty-bombers, the German Ju 87, and the Italian Caproni 313. *Flight*, October 28, 1943, pages 473–477, 13 illus.

Closing in on the Nazis. Alexander Kiralfy. A description of how Allied air power is now going in for the "heavy work" of stopping the enemy from digging in and is breaching the walls he has already erected to prevent invasion. A map is furnished to give an idea of the area that must be defended by Germany if she hopes to avoid defeat. *Flying Aces*, January, 1943, pages 10, 11, 40–42, 4 illus.

Arabian Air Force. Frank Cunningham. This article on the progress of aviation in Iraq contains information on the background, establishment, equipment, training, and personnel of the country's military air force. In addition, it covers commercial air-line development, government sponsorship of civil air training, airports, and climatic conditions. Consideration is also given to the military, political, and geographic significance of Iraq. *Flying*, December, 1943, pages 47, 48, 185, 186, 3 illus.

Airpower—The Decisive Arm! B. D. and O. H. Kneen. An outline is given of how air power has caused a complete revision of the strategy and tactics of global warfare and produced many new problems. It is explained that as a result of improvements in aerial strategy and tactics, the enemy is now defeated by a whole series of coordinated aerial operations. *Flying Aces*, December, 1943, pages 28, 29, 56, 58, 60, 5 illus.

Bomb the Axis from America! Major Alexander P. de Seversky. The advocate of "victory through air power" urges that the United States abandon what he calls old concepts of warfare and obsolete weapons and build its war forces around strategic aviation through the employment of long-range bombers that can take off from land bases, cross oceans, strike against the enemy in his own country, and return to their transoceanic bases. He presents arguments for feasibility of such aircraft, quoting industrial and military leaders to show that they can be built but that the industry is hampered by outmoded thought rather than lack of technologic progress.

In this article, Major de Seversky condemns the inadequacies of carrier-based aircraft, explains the difference between tactical and strategic aviation, and describes the curtailment of other strategies that must be effected to enable the building of long-range strategic air power. He estimates that the building of such a bomber fleet will take two years, presenting evidence in support of the fact that the war may last much longer than that. *The American Mercury*, December, 1943, pages 675–683.

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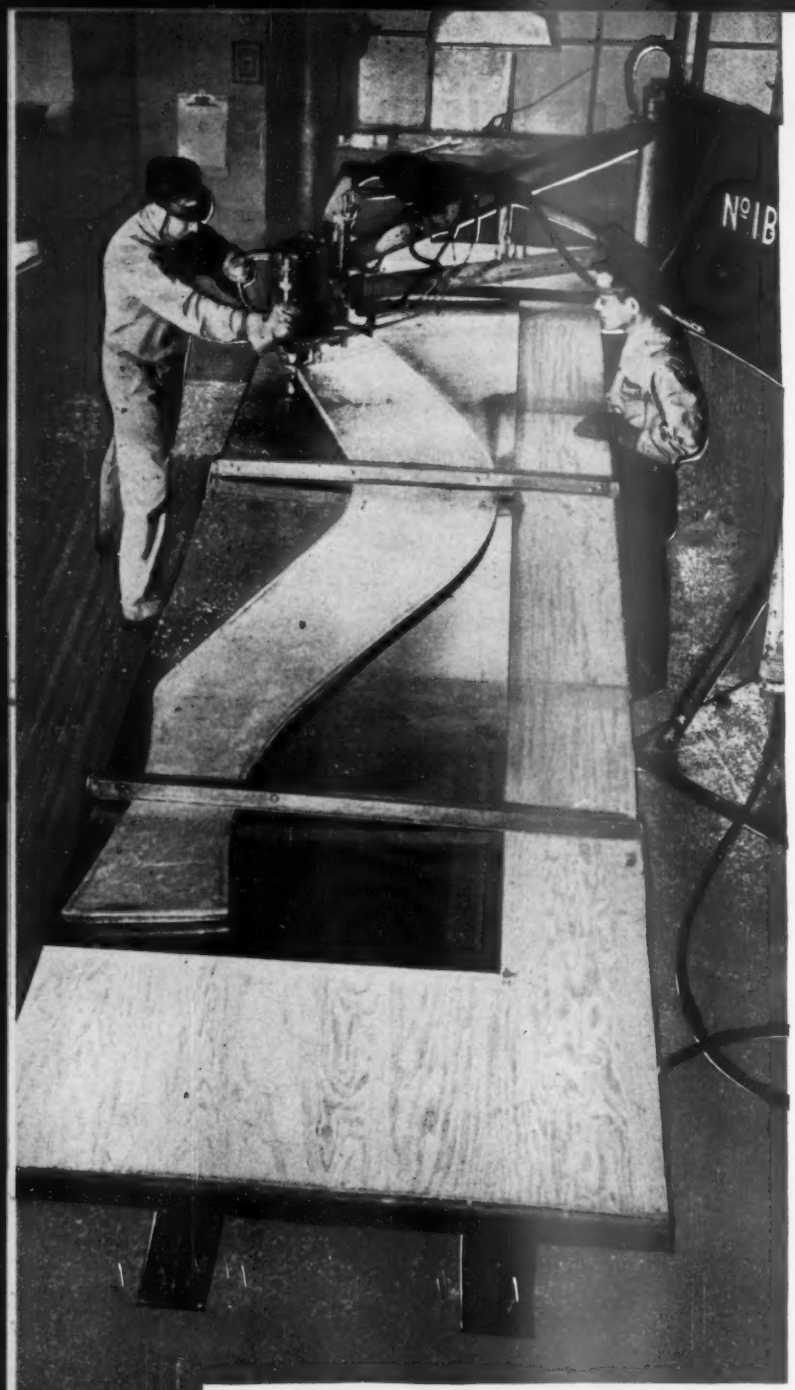

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Air Transport

They Skyblazed Africa and the East "Way Back When." An account of how prewar air routes were established by the British over Africa, the Middle East, India, the Far East, and Australia. The brief history includes a review of the Cape-to-Cairo, Britain-to-South Africa, Khartoum-to-Lagos, Cairo-to-Bagdad, Calcutta-to-Singapore, India-to-Australia, and Britain-to-New Zealand developments.

Besides noting the various types of obstacles that were encountered in the pioneering of these routes, the article mentions the more important air terminals along each route. *Aviation*, November, 1943, pages 196, 197, 281, 282, 285, 286, 289, 290, 5 illus.

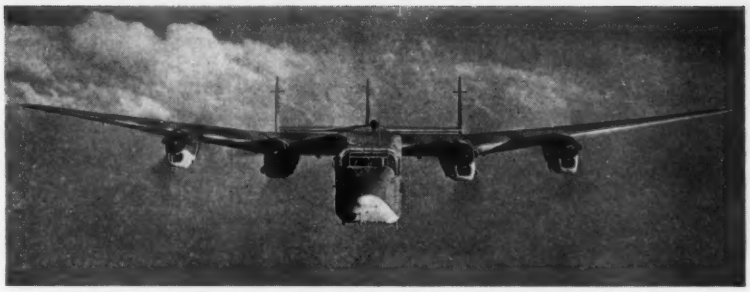
Why Airline Engineering? R. Dixon Speas. The role of the engineering department in air-line management is discussed. It is stated that air-line engineering offers the means whereby efficiency, as well as equipment and operating-procedure safety, can be incorporated into the working foundation of air-line management. The complex nature of aircraft being designed and constructed for use on air lines of tomorrow, and the expanded services as proposed dictate the necessity for each air line to survey its engineering needs and plan for a corresponding engineering capacity.

It is held that the factor of efficiency has been somewhat neglected by the air lines in deference to more immediate problems of safety, operations, and maintenance. The solution to many of these immediate problems appearing at hand now allows a more complete consideration of efficiency aspects of air-line management. The efficiency phase of engineering responsibility will in the future be a prime factor in establishing the business success of air lines, and therefore air-line management must consider its engineering needs in this respect and plan accordingly. *Air Transport*, November, 1943, pages 28–31, 6 illus.

Aviation's Living Space. Thomas B. Bourne. The Director of Federal Airways in the Civil Aeronautics Administration surveys the needs for new procedures in air traffic control to take care of the postwar expansion of air transport up to the year 1950.

In the first of two articles, he gives approximate estimates of the volume of commercial air traffic and discusses means for spacing and separating air lanes and for determining the airspace capacity of a given airway. New systems for control of incoming aircraft and improved airport construction are suggested. *National Aeronautics*, November, 1943, pages 15, 50, 2 illus.

Make Your Reservations Early. The United Air Lines' reservation system is outlined. With its network of communications spanning 7,800 miles and connecting all offices simultaneously, the report is that the company can handle in 10 min. a request for a seat on a flight to be made from the opposite coast and that reservations for a local flight can be made in as little as 2 min. Ten key centers are connected on separate trunk lines to avoid bottlenecks. At the switching center messages are recorded on a tape that passes to a transmitter and are automatically forwarded to the proper station. Telegraph, radio, and leased telephone lines are used. To illustrate how the work is performed, the article follows a typical reservation through its routine course from the time the passenger requests a seat until passage is booked for him. *Aviation*, November, 1943, pages 199, 201, 5 illus.



British Official Photograph

The Avro York—the civil transport version of the Lancaster bomber. Externally the main points of difference between the York and the Lancaster are the shape of the fuselage and the introduction of the triple-fin tail unit in the York. The York's wing span is 102 ft. and its overall length is 78 ft. It is powered by four Rolls-Royce liquid-cooled Merlin engines.

Twenty Five Years of Air Mail Growth. Charles I. Stanton. Commemorating the 25th anniversary of the first scheduled air-mail flight and the 40th anniversary of the Wright Brothers' first flight at Kitty Hawk, the Civil Aeronautics Administrator reviews the progress that has been made from the methods and equipment of 1918 to those of the present day.

In addition to summarizing the important developments that emerged from the first 25 years of air-mail experience, he also indicates what may be expected from the next era of commercial flying. Airways, communications, navigation aids, and multiengined aircraft are described as four of the major results of the 1918–1943 air-mail activities. The article is supplemented by several graphs portraying the increase in air traffic from 1932 to 1942 in terms of revenue passengers carried, revenue miles, mail (ton-miles), flying personnel, total personnel, and miles flown per fatal accident. *Flying*, December, 1943, pages 10–13, 31 (Air Commerce Department), 10 illus.

North to Everywhere. A discussion of world air routes over the Arctic regions stresses the part played by Vilhjalmar Stefansson in providing the public with an understanding of the Arctic regions and how they may be used for international air routes. *National Aeronautics*, November, 1943, pages 12, 13, 2 illus.

'Airlines Should Maintain Personal Touch.' E. J. Foley. A discussion of future service to the air-line passenger notes that the passenger has been and is now treated as a guest of the air line from the moment he calls to inquire about schedules. Whether or not tomorrow's passenger traffic volume will permit the continuation of this relationship is considered. It is stated that present knowledge falls far short of that required to plot a practical attractive course of service to the passenger.

The writer confines his comment to a simple exposition of the several services that may be affected. *American Aviation*, December 1, 1943, pages 73, 74, 1 illus.

Range, Endurance and Economy. Roy E. Marguardt and Robert De Vault. In this article, which is one of a series, the writers show how the rate of fuel consumption affects the range, endurance, and economy of aircraft operation. The subject is covered in sections dealing with the specific fuel consumption, cruising charts, range and endurance at constant speed, operating costs, the effect of change in flying weight, the rapid estimation of maximum range, and the ultimate range. *Western Flying*, November, 1943, pages 82, 84, 88, 90, 114, 12 illus.

Britain's Prelude to Postwar Air Transport. Oscar Leiding. A chronologic outline of the development of the routes and equipment of British air lines from 1919 to 1943 is presented. It is hoped that the outline may indicate how United States and British operators can cooperate in the postwar period. *Air Transport*, November, 1943, pages 32–36, 5 illus.

Holland's Air Empire. One of a series of articles on major foreign air lines reviews the activities of the Royal Dutch Airlines. The growth

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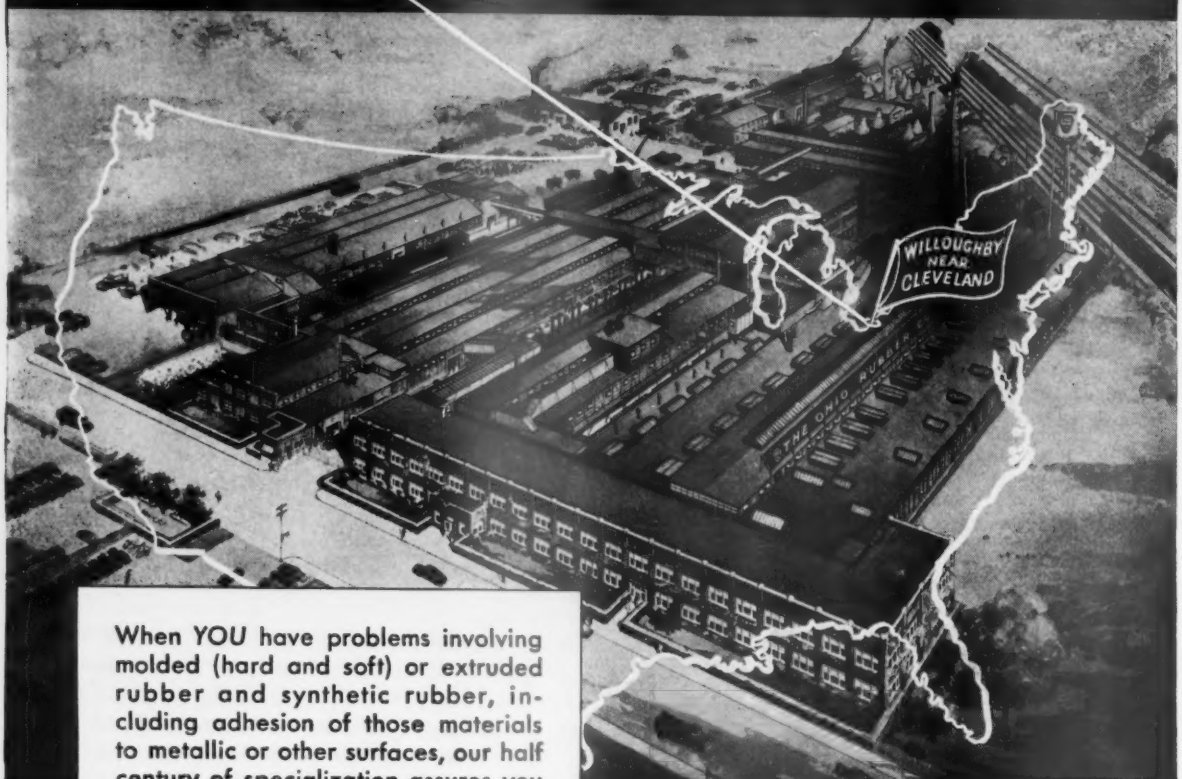

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of KLM is traced, its equipment is described, and plans for future expansion are discussed. *National Aeronautics*, November, 1943, pages 16, 17, 1 illus.

Air Plan for Rural America. Jodie Ligon. The plan submitted by Braniff Airways to the Civil Aeronautics Board recently, under the C.A.B.'s project of investigating feeder airline service, is outlined. It calls for "trade area" feeder air lines radiating from the nation's 60-odd major trade centers. Kansas City, Mo., was chosen as a typical trade center upon which to base the proposals. Among the points covered by the report are: comparative costs of air-mail and present rural mail service; routes and schedules; the type of aircraft required; cost of ground equipment; operational base requirements; radio apparatus; airports; total invested equipment capital necessary; personnel; and ownership. Figures showing the economic feasibility of the plan are quoted. *Southern Flight*, November, 1943, pages 30, 31, 40, 44, 2 illus.

Airline Rates Schedules and Research. Charles Gallo. As carried on by the Rates, Schedules, and Research Department of Transcontinental & Western Air, Inc., the importance of research in enabling the air lines to achieve more economical operation and better service is indicated. Trends in the development of the three primary sources of air transport revenue—mail, passenger, and express carriage—are surveyed. Several charts illustrate the article. One depicts the air-mail pound-miles flown; another, the air-mail plane-miles flown; a third, the source of revenue of air-line companies. Three other charts show the upward curves of United States express revenues, express pounds carried, and express pound-miles flown. *Flying*, December, 1943, pages 26–29, 6 illus.

Army by Airmail. George Johnston. An account of how planes of the U.S. Army Air Forces Troop Carrier Command flew reinforcements through the Owen-Stanley Mountains to Australians encamped in the jungles of New Guinea, kept them stocked with air-borne supplies, and evacuated their wounded. In addition to depicting the hazardous flight conditions that were overcome by the practically unarmed transport planes, the article notes that the operations have formed a basis for future aerial warfare experience in the Southwest Pacific. *Collier's*, December 4, 1943, pages 30, 32, 33, 2 illus.

Airplane Descriptions

Development and Engineering Features of Lockheed P-38 Fighter. A summary tracing the evolution of the Lockheed Lightning fighter from the prototype to the latest projected design. The details of the latest version are restricted for military reasons. *Automotive and Aviation Industries*, November 1, 1943, pages 32–36, 5 illus.

Heinkel Development. A series of photographs illustrates the different versions of the Heinkel 111. The development is traced from the Heinkel 111V1 through the 111P2. *The Aeroplane*, October 15, 1943, page 439, 17 illus.

An Unorthodox Swedish Project. Accompanied by a general arrangement drawing, specifications and descriptive data are presented on an asymmetric fighter bomber projected by a Swedish aircraft engineer, Sigurd Isacson. Details are based upon information from the Swedish magazine, *Flyg*.

In order to obtain high speed without sacrifice of armor and armament, the design includes a high-speed wing section and two powerful engines placed in tandem on an asymmetric layout. It is estimated that this combination results in a drag reduction of about 10 per cent. The power plants specified are two Napier Sabre engines, assuming 2,350 hp. for the take-off and fitted with flame-damped and efflux-reaction exhausts. Provision for a semiprone position for the pilot permits not only a fuselage of small cross section in front but also greater maneuverability of the plane, since in this position the pilot can tolerate increased gravity pull. It is pointed out that, through the symmetry of the wing itself and the even placement of fuel, bomb, and ammunition loads on each side of the center of lift, this project overcomes one of the disadvantages of asymmetric aircraft—the difficulty of getting symmetric loads. *Flight*, October 21, 1943, page 452, 1 illus.

British 'Queen Mary' Blueprints Ready. Information is given about a proposed British multiengined airliner of large capacity and long range, designed by F. G. Miles and being developed by Phillips & Powis Aircraft, Ltd. In the maximum-range version, it would be able to cover 3,450 miles carrying 50 passengers and a crew of five, at a cruising speed of 350 m.p.h. against a headwind of 50 m.p.h. at 7,000 ft.; as a medium-range plane, it would carry 100 passengers; and as a short-range craft, it would transport a correspondingly larger load with an operational range of 1,100 miles. It would also be convertible into a bomber or troop carrier.

The design provides all-metal construction, with special attention to the manner in which the wings merge into the fuselage. The complete power units would be housed in the wings, where they would be accessible through removable panels for servicing purposes. Details of the construction and layout are given, and specifications are tabulated, including dimensions, power plants, weights, and performance. The span is 150 ft., gross wing area is 2,350 sq.ft., loaded weight is 130,000 lbs., and the power plants consist of eight Rolls-Royce engines giving a maximum of 14,000 hp. at 425 m.p.h. at 16,000 ft. *American Aviation*, November 15, 1943, pages 17, 48, 3 illus.

Cargo by Commando. Esther H. Forbes. A survey of the design and structural characteristics of the Curtiss C-46 Commando, with some notes on its performance record. Attention is drawn to the fact that the commercial experience gained through the Commando's first design as a commercial transport was able to contribute to military developments in its redesign as an Army cargo plane and that now, in turn, its war experience has led to improvements incorporated in a new commercial version of the C-46—the 20-C which is planned to be ready for immediate production at the end of the war. *Southern Flight*, November, 1943, pages 32, 33, 5 illus.

Four Basic Types of Postwar Plane Are 'On Paper' at ATA. Gerald B. Dobben. Brief outlines are given of the general characteristics of four basic types of commercial aircraft designed to cover the range from the short-haul passenger and cargo field to the luxury passenger sleeper for intercontinent and transoceanic service. As suggested by the Committee on Aircraft Requirements of the Air Transport Association of America, these are: the ATA-A1, for short-haul passenger and cargo work; the ATA-B1 for routes of heavy traffic density and stops scheduled from 50 to 400 miles apart; the ATA-C1 medium-range airplane with pay load of about 20,000 lbs. for use on routes having stops from 250 to 1,000 miles apart; and the ATA-D1, a medium-long-range craft, carrying approximately 25,000 to 30,000 lbs. of pay load, with a 100- to 120-passenger-day plane version for heavy traffic routes of medium range in flights of 200 to 800 miles. Specifications of each of these types are set forth with reference to the provisions for passengers, baggage, and cargo, performance, equipment, and other requirements. *American Aviation*, November 15, 1943, pages 31, 48, 50.

Spanish and Mexican Trainers. Data on two new training airplanes are contained in this brief article. One is the Spanish H.M.-1; the other, the Mexican Teziutlan. The H.M.-1 is a cantilever two-seater, low-wing monoplane, powered with an air-cooled, in-line engine. Wings in trapezoid plane have rounded tips and a moderate dihedral angle from the roots and are equipped with landing flaps. The undercarriage is

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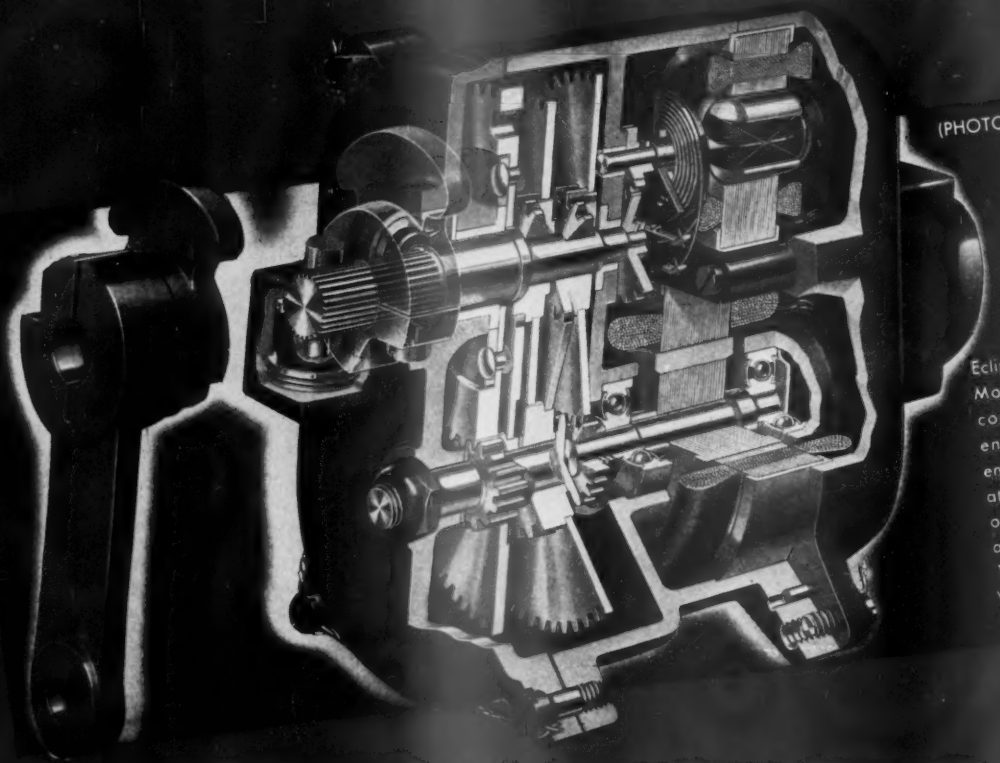

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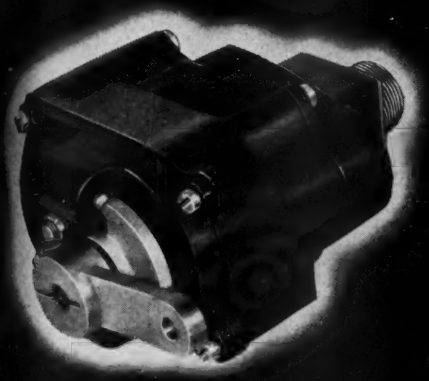

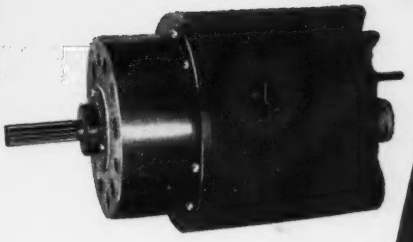

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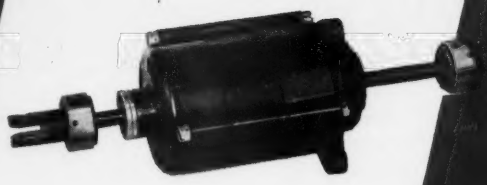

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fixed, with faired wheels. Figures on the power plant are not disclosed, but the particulars released by the Spanish Air Ministry on the dimensions and performance of the aircraft are recorded. The Teziutlan is a cantilever low-wing monoplane, built of mahogany plywood, powered by a four-cylinder, 125-hp. Lycoming Boxer engine. Its span is 38 ft., length is 23.9 ft., height is 6.23 ft., and empty weight is 950 lbs. The flying weight is 1,630 lbs., range is 480 miles, and cruising speed is 102 m.p.h., with top speed of 108 m.p.h. It climbs at 1,370 ft. per min. and has a ceiling of 22,000 ft., according to the description. *Flight*, October 21, 1943, page 458.

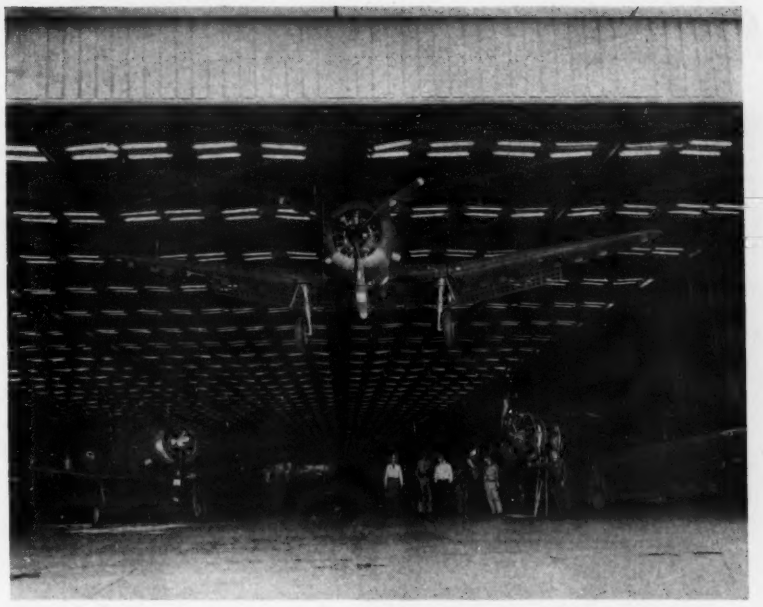
Flight-Testing the Zero. C. Budd Dugan. Based on the experience of an American pilot assigned to test-fly an almost undamaged Zero captured from the Japs, flight and construction characteristics of the Japanese fighter plane are summarized. While highly maneuverable, the Zero's maneuverability is reported not to exceed that of American planes. In addition, it is said to be slower than United States fighters, to afford absolutely no protection for the pilot in armor or bullet-proof glass, and to be extremely vulnerable in its fuel-line and tank construction. Numerous other details of the construction, equipment, and armament of the plane are given. *Flying*, December, 1943, pages 65, 66, 138, 4 illus.

Twenty Years of Messerschmitts, 1923–1943. A description of Messerschmitt models and their development from 1923 to 1943. General design features of the many models produced over this period are presented in tabular form. *The Aeroplane Spotter*, November 4, 1943, pages 258, 259.

The Piaggio 108. Features of an Italian four-engined heavy bomber, the Piaggio 108, are examined. The unusual armament (which, it is reported, seems to have been designed on the assumption that head-on attacks would rarely, if ever, be encountered), the inclusion of a number of items of German equipment, good interior arrangements, and crudities in the engine-starting and flap-operation systems are among the characteristics given. Details on the Piaggio 108 show it to have a take-off speed of about 90 m.p.h., a cruising speed from 175 to 180 m.p.h., and a normal range of about 1,000 miles. The total fuel consumption rate of the four Piaggio 1,300-hp. air-cooled radial engines is said to be 240 gal. per hour, top speed of the bomber about 290 m.p.h. at 11,480 ft., and service ceiling 25,000 ft. *Flight*, October 21, 1943, page 458, 1 illus.

Airports

An All-Weather Airport Runway. J. J. Cermak. Details are given on a special clay tile construction for airport runways, designed to prevent the accumulation of moisture, snow, ice, frost, and sleet by using the tile to insulate the concrete paving slab from the ground. Devised by the Structural Clay Products Institute, the basic units are made of structural clay tile with hollows or voids running through them which form insulating layers of air. The construction of the runway, closely following roadway construction, calls for the tile to be laid end to end. Each row is started with a half length and soffits are placed between the tile rows. Load distribution is such that a load applied to any point on the runway is distributed to include two vertical walls of the tile. Dissipation of drainage is also provided for in the construction of the runway. *Flying*, December, 1943, pages 14, 15, 30 (Air Commerce Department), 4 illus.



A completed Douglas Dauntless being removed from the assembly building by overhead crane.

Stop Airport Fires. E. J. Robins. Airport fires and their prevention are discussed. Examples of the destruction caused by airport fires are given. The responsibility of the management in preventing serious airport fires is shown. *Aviation Maintenance*, December, 1943, pages 90–92, 188, 192, 5 illus.

Toward a Better Understanding of the Fundamentals of Airfield Development. M. W. Cochran. A study of the primary considerations in building an airfield. The factors discussed are size, approaches, location, topography and soils, design of flightways, and atmospheric conditions. *Midwest Aviation and Yachting*, November, 1943, pages 15–17, 2 illus.

Factors in Airport Design. Maurice Roddy. A discussion of major considerations in the planning and development of an airport. Featured among these are aircraft performance, airport location, soil texture, and the community. The following factors are listed for inclusion in preliminary study: (1) trading area and population of the city; (2) distance between adjoining airports or cities and the area in square miles to be served by the airport; (3) local topography; (4) local flying; (5) present and future intra- and interstate scheduled air-line requirements; (6) seasonal fluctuations of air-line traffic caused by tourist travel; (7) postal receipts of the city and its trading area, to evaluate air-mail and express possibilities; (8) potential aviation business in the locality, based upon retail sales of the city and its trading area; and (9) national defense.

Named among the influencing factors that determine the required distance for safe take-offs and landings are: characteristics of the site (including nature of surrounding topography and obstructions, elevation above sea level, and character of landing strips or runway surfaces); meteorologic conditions (including barometric pressure, temperature, and wind direction and velocity); and aircraft performance. In tabular form, the article lists recommended airport design standards, minimum recommended facilities, and the effect of altitude above sea level on airport size. *Flying*, December, 1943, pages 16–18, 32 (Air Commerce Department), 1 illus.

Maintaining the Nation's Model Airport. J. Earl Steinhauer. The task of maintaining the Washington National airport, as carried out by the Civil Aeronautics Administration employees under the supervision of the Airport Manager, is described. The divisions of the operations staff are listed. Various phases of operation

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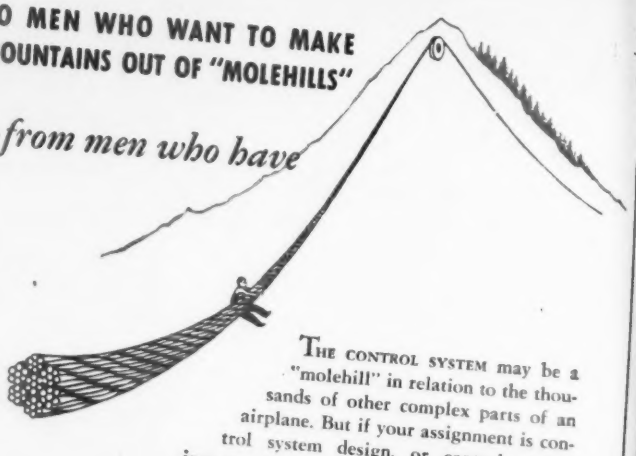

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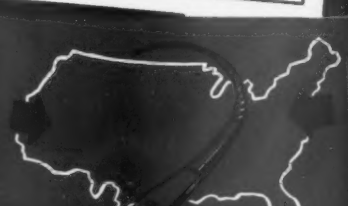

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are discussed. A diagram of the airport is presented. *Aviation Maintenance*, December, 1943, pages 79–82, 11 illus.

Airports and Air Traffic Control. Glen A. Gilbert. First of three articles examining the relation of airports to air traffic control. Claiming that in the future the capacity of the airport to handle traffic will be the only factor limiting the movement of aircraft, the writer presents "airport specialization" as the solution to the problem of having anticipated increases in air traffic surpass maximum capacities of "ideal" airports. That the increase *will* surpass maximum capacities is demonstrated mathematically.

The specialization plan is based upon the use of separate airports for different types of aircraft operations as the growth of air traffic in a given city begins to exceed the maximum expansion of one airport. With airport traffic divided into five major categories—(1) commercial passenger, (2) commercial cargo, (3) civil itinerant, (4) local training and pleasure traffic, and (5) military traffic—the first recommended step in airport specialization is the segregation of military traffic by the establishment of a military air base. When additional airport facilities are required, the second step suggested is the provision of one airport for traffic types (1) and (2) and another for types (3) and (4). Types (1) and (2) would subsequently be segregated, as would types (3) and (4), resulting ultimately in four major types of civil airports for larger cities.

Four illustrative graphs show the plotting of lines for traffic at an airport where pronounced peaks occur during the morning and evening, hourly traffic movement at an airport where flow is fairly constant during daylight hours, aircraft movements at airport of city with 1,000,000 population, and traffic capacities of an "ideal" metropolitan city airport. *Flying*, December, 1943, pages 20–24 (Air Commerce Department), 4 illus.

Armament

The Caliber .50 Machine Gun. Brig. Gen. James Kirk. Beginning with a brief review of the machine guns with which combat aircraft of the first World War were armed, the development of the 0.50-caliber machine gun is reviewed. The three main types of this gun are described, and the service to which each is applied is outlined. It is stated that the M2 0.50-caliber aircraft machine gun is at present the most important aircraft weapon used by the Army Air Forces. This is credited to its high rate of fire of 800 shots per min., combined with its powerful striking effect and long range, exceeding that of the 20-mm. cannon used by the Axis forces. The gun is said to be one of the few weapons used alike by all branches of the armed services of this country.

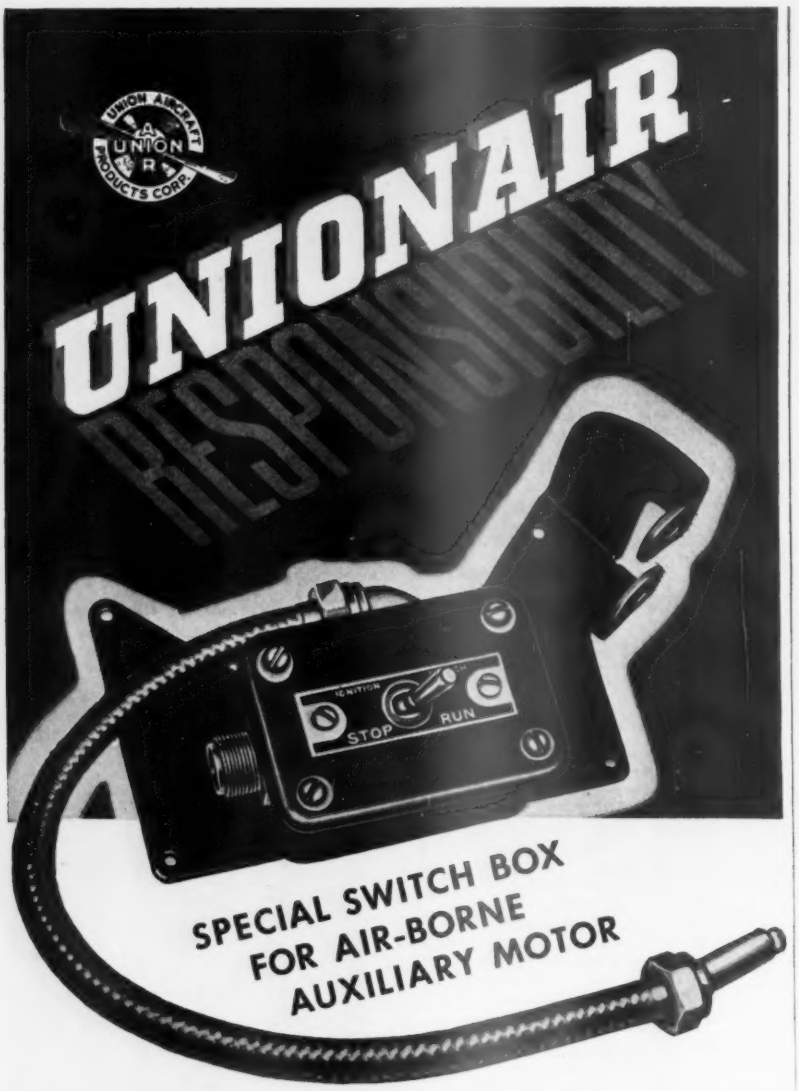
Instances are recounted of the use of this type of gun in several of the important battles of the present war, and of the contribution which it has made to American victories. The benefits arising from the features of interchangeability of parts are emphasized. *Army Ordnance*, November-December, 1943, pages 564, 565, 2 illus.

Going Great Guns. Nandor S. Klein. The evolution of aircraft armament is reviewed, starting from the introduction of gun equipment on airplanes in August, 1914. Present trends toward aerial cannon are indicated. In addition to a consideration of the comparative qualities of machine guns and cannon, the article includes notations of the types of airplane armament used by various countries. *Skyways*, December, 1943, pages 24–26, 72, 74, 10 illus.

The profile view (above) of the nose section of a North American B-25 Mitchell bomber shows the 75-mm. cannon and two 0.50-caliber machine guns. This model of the B-25 has a shorter nose section than earlier B-25's. An all-metal section replaces the glass-enclosed bombardier's compartment. Note the size of the 75-mm. shell as shown in the photograph at the right.

Dialing for Destruction. R. G. Picinich, Jr. A recital of the action taking place in an air attack on Berlin, during which Flying Fortresses overcome assaults by enemy fighters and proceed to their bombing objective, serves as an introduction to a description of the construction and operation of the Sperry automatic computing gunsight. The story is not a portrayal of an actual air raid but is descriptive of incidents that have taken place during some 80 attacks made upon the German capital. The information on the gunsight is supplemented by data on power turrets and comments on German aircraft armament. *Flying Aces*, January, 1943, pages 18–20, 68, 70, 13 illus.

Proving Ground for Destruction. A series of notes relative to improvements in defensive and offensive armament, based upon reports from the armament laboratory of the Army Air Forces Matériel Command at



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Wright Field. Some major advancements in fire power since the previous war are listed as having been perfected by engineers at Wright Field with the cooperation of various commercial manufacturers. These include: (1) development and improvement of the high-cyclic rate small-caliber machine guns, the most important of which is the 0.50-caliber gun and aircraft cannon; (2) new electric and hydraulically controlled fire-control systems and remotely controlled and locally operated multiple machine gun turrets, and also fire controlling devices such as so-called computing sights now responsible for so many enemy airplane casualties; (3) practical application of new and unerring bomb sights and allied equipment; (4) the 20-mm., 37-mm., and larger caliber aircraft cannon; (5) bomb racks, shackles, release mechanisms, etc. Among other developments are: a chute type of feeder for installation in planes and turrets which increases the number of rounds of ammunition that can be carried, armorproof vests and helmets for combat crews, and the carriage of bombs inside the plane instead of hanging on the wings. *Western Flying*, November, 1943, pages 44, 45, 110, 6 illus.

The Facts About Fighter-Plane Firepower. Arthur Grahame. Information is given on the armament of Allied and enemy fighters. Fire power details of the most powerful fighting planes that the five leading belligerents have put into the air to date are given, as well as a table of data on five outstanding aerial guns. Silhouettes of aircraft show the types and positions of fighter armament. *Popular Science*, January, 1944, pages 76–83, 186, 15 illus.

Electric Gun Sight. Wayne Gordon. A description of the British gun sight, Mark II. By means of this device, firing data are provided automatically for the gunner or pursuit pilot who formerly had to estimate range and course, usually through the employment of the ring and bead sight. As explained, the principle of the electric gun sight is that the target itself becomes, in effect, the forward bead sight of the gun. The ring sight, by which that target is coordinated into the line of fire of the plane's armament, is a suitably illuminated reflection on a small glass screen. By two dial settings on the device, the image and the target on which it lines up automatically give the information instead of requiring the gunner to devote study in getting the bead, target, and ring sight properly lined up.

An additional advantage of the electric gun sight is that it is adaptable for night sighting. The article contains a detailed photograph of the equipment. *Flying*, December, 1943, pages 50, 189, 190, 3 illus.

75 mm. Cannon Gives "Mitchell" Formidable Firing Power. A brief description of the latest armament of

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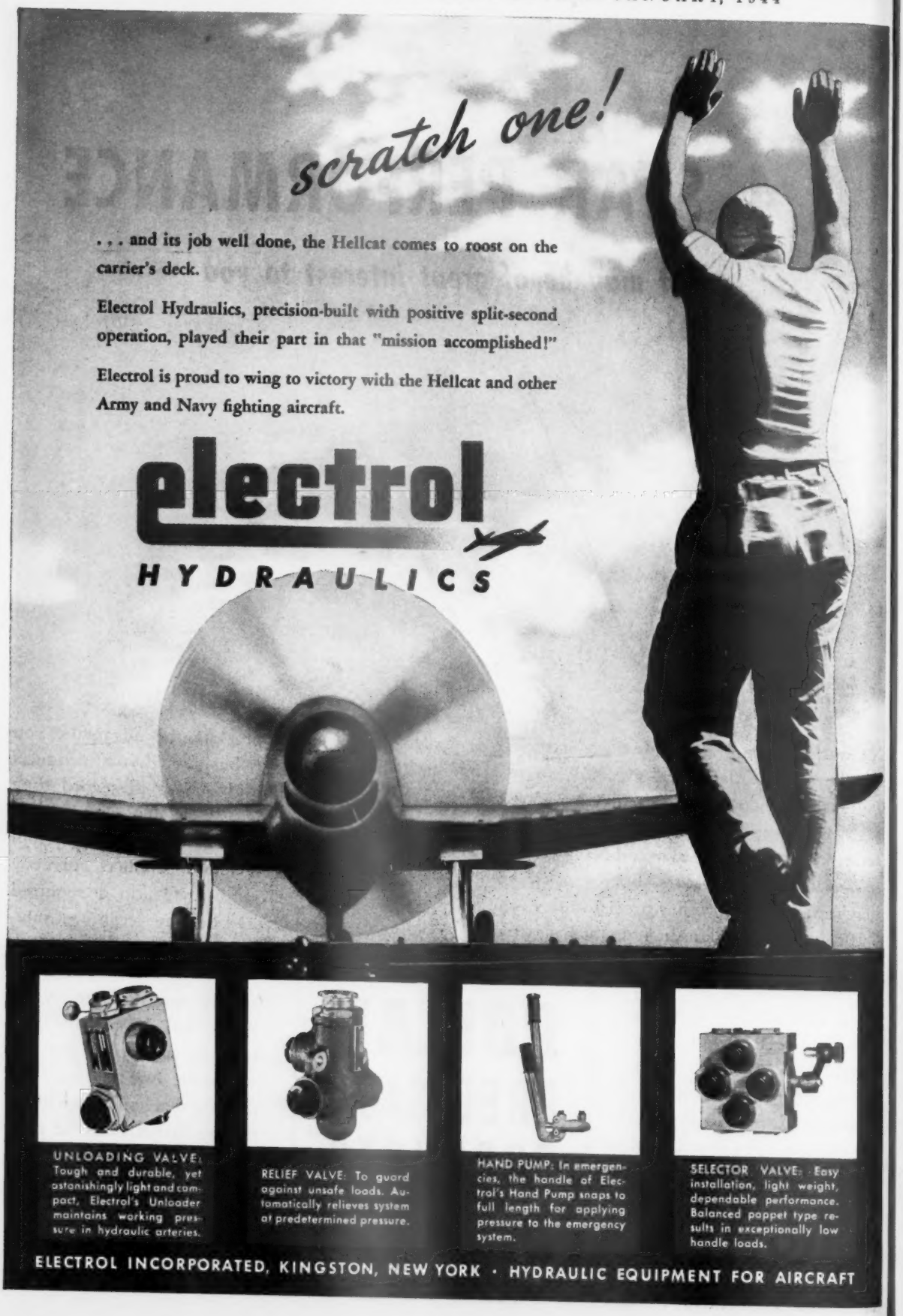
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the B-25 Mitchell. A 75-mm. cannon and two 0.50-caliber machine guns are mounted in the newly designed nose. It is stated that 75-mm. cannon are the largest known weapons ever mounted in an airplane. The recoil for the discharge of this cannon is taken by a secret-type, hydrospring recoil device. *Aviation News*, December 6, 1943, pages 10, 11, 1 illus.

Business and Finance

Cancellation Demands Action—And Quick. Raymond L. Hoadley. The need for immediate legislation with regard to the cancellation of war contracts is demonstrated. Reviewing specific cases in which war contractors have already had large amounts of working capital tied up in cancellations, the writer states that Congress should recognize that the First War Powers Act, rushed through just after the attack on Pearl Harbor, was only temporary legislation and that new laws are needed to make settlements which are binding and final. Outlining the unsuccessful efforts of the War Production Board to arrive at uniform termination rules and procedures, he contends that only Congress can bring order out of the present confusion surrounding war contract cancellations and cites some of the more pressing problems that must be solved. To do this, the writer claims, requires clarification of the status of the General Accounting Office, creation of an impartial court of claims to which prime contractors and subcontractors may turn when necessary, and the passing of enabling legislation to relieve contracting officials of individual liability for settlements subsequently considered excessive.

He points out the need for: Government provision for inventory protection; standardized plant procedure which will assure quick and accurate checkups on Government-contracted materials; and mandatory legislation to free the money tied up in war work upon cancellation, with advance payments of as much as 90 per cent. Other questions advocated for Government settlement are those of: subcontract claims above $25,000; severance pay for employees; one overall claim regardless of the number of contracts involved; whether large or small companies are to have their contracts terminated first; and whether contracts are to be terminated immediately after the war or if a "tapering off" policy will be followed. *Aviation*, November, 1943, pages 119, 320, 323, 324, 327, 328, 2 illus.

Distributor's Place in Industry Studied. E. J. Foley. The role of the distributor in the aviation industry is discussed. It is believed that in the postwar period the distributor can carve a place for himself far more dominating than in the past. It is suggested that the distributor function might be broken down into two branches, the general distributor doing business with the private flying public and the distributor who sells to industry customers, the most important of which would be the air lines. *American Aviation*, November 1, 1943, pages 74, 76, 1 illus.

More Substance to Airlines. Roger Wilco. Attention is drawn to the constantly strengthening position of the equity holders or owners of the air lines. It is noted that a share in an air line today represents considerably more substance than it did years ago and that virtually all this improvement stems from earnings being returned into the industry. This is best illustrated by measuring the growth of the separate air lines in terms of net assets per share of common stock throughout the years.

A table is furnished that presents this trend over the last 4½ years for four of the major air carriers. The writer discusses the increased values, the earnings retained, mail payments, and the reward for promoters. *Air Transport*, November, 1943, pages 52, 53.

Where Are Those Dividends? H. L. Federman. An analysis of why cash dividends on aircraft equities have been small despite established success in earnings. Reviewing the industry's financial history, the writer shows that in all periods of its existence capital was needed either for development, contingency reserves, or reserves for taxes, renegotiation, and reconversion. Thus, dividend disbursements had to be small. Specific examination is made of certain phases in the dividend trends of stocks of United Aircraft, Curtiss-Wright, Consolidated Vultee, Republic Aviation, Douglas Aircraft, and Eastern Air Lines. In one of two tables accompanying the article the comparative earnings per share and dividend payments per share of major aircraft companies during the last 3 years are listed. The second table gives the monthly report of Barron's stock averages for aircraft manufacturers' equities, air transport equities, and 50 representative stocks. *Aviation*, November, 1943, pages 190, 252, 253.

Design for Survival. John Foster, Jr. Concerted effort on the part of the aircraft industry in guiding Congress to satisfactory solutions of the industry's war-termination problems is urged. Two resolutions passed by the Economic Development Committee of the Aeronautical Chamber of Commerce are recommended as the basis for a course of action. Dealing with contract renegotiation and termination, these resolutions are discussed with direct reference to specific clauses. *Aviation*, November, 1943, pages 118, 253.

Civil Aviation

Air War on the Grasshopper. S. R. Winters. This article deals with the control of insect infestation through the distribution of poison bait by means of airplanes. Special airplanes and airplane modifications, designed and used for this purpose by the Bureau of Entomology and Plant Quarantine at the United States Department of Agriculture, are described. The superiority of the airplane system of combating insects over former agricultural hand methods is interpreted in terms of the amount of acreage covered from 1934 to 1941 and the amount of crops that were harvested as a result of the airplane poison-bait distribution. *Flying*, December, 1943, pages 32, 33, 136, 4 illus.

Companies

40 Years from Kitty Hawk. Written in defense of accusations against the Curtiss-Wright Company, this is an analysis of the company's contributions to the war effort together with a brief outline of its history. The balance sheet of current Curtiss-Wright production is summarized as follows: Despite one relatively inefficient aircraft engine plant, there are seven others producing excellent radials at a spectacular pace; although a dive bomber and an observation plane manufactured by the organization failed to meet expectations, it produces a topnotch, all-purpose plane in the Warhawk, an excellent cargo plane in the Commando, and two efficient trainers; and, in addition, Curtiss-Wright has four plants building propellers for the Allies. *Air News*, October, 1943, pages 19–21, 12 illus.

Control Equipment

Hydraulic Control of Aircraft Engine Temperature. William A. Ray. A discussion of the part played by hydraulic control mechanism in steadying temperatures in aircraft power plants. It is noted that the aircraft engine, which possesses one-sixth the weight per horsepower of the automobile engine and is subjected to much greater changes in load and atmospheric conditions, requires a sensitive, quick, but restrained temperature-regulating apparatus. The application of hydraulic-type temperature controls to aircraft-engine lubricating systems is discussed. Hydraulic controls are being successfully applied to the positioning of adjustable flaps that control the flow of air past the oil radiator and, in liquid-cooled engines, past the main radiator. *Automotive and Aviation Industries*, November 1, 1943, pages 25, 58, 60, 1 illus.

Aircraft Powerplant Control Systems. Norman W. Rubin. Noting that backlash, or loss of motion in the control run, is the prime potential trouble with mechanical-engine-control systems, the article lists the considerations involved in the design of a backlash-proof system. These in-

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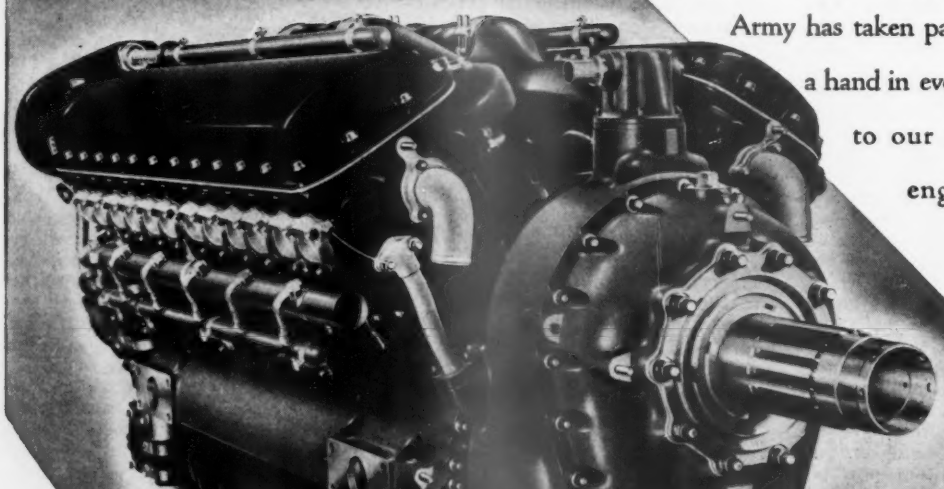

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clude: the sum of the frictions in the system; clearances of the various joints; the force required to move the control; flexibility of the components; and the possibility of change in the length of the control run caused by stretching of cables, by expansion or contraction under temperature extremes, and by flexure of the structure to which components of the control system are attached. Each of these possibilities is reviewed in considerable detail, and advice is given for the design, selection, and installation of control units in such a way as to lessen the probability of failure. Among the special conditions to which attention is paid are the controls for elastic-mounted engines and the devices used for such applications. *Aero Digest*, November, 1943, pages 198, 204, 451, 459, 463, 2 illus.

Design

Landplanes or Flying Boats. A. E. Raymond. The Vice-President of Engineering of Douglas Aircraft cites the advantages of landplanes over flying boats for overseas transportation. He states that, after considerable study and experience in building both types of planes, it is the Douglas Company's opinion that, except in certain special operations, landplanes provide by far the better answer to the transoceanic problem. Some of his reasons for advocating the landplane are: Landplanes do not necessitate auxiliary transportation services for cargos destined for inland cities; with the multiengined aircraft of today, there is little need for landing during overseas flight and in the case of emergency landings, the seaplane is claimed to have no better chance than the landplane (particularly if the latter is low-winged and properly designed for flotation); the cleaner aerodynamic shape of the landplane fuselage yields increased speed and range for a given fuel load; the development of pressure-cabin airplanes for flight at high altitudes results in less increase in structural weight for the landplane with its round fuselage than for the flying boat with its flat sides and bottom elements; the sealing of the landplane fuselage to make it airtight also makes it watertight; the constant presence of salt water in the case of the flying boat tends to promote corrosion and increase the amount of maintenance required; maintenance work for the flying boat, whether done ashore or afloat, is usually more difficult or more costly; flying boat schedules are liable to disruption because of river and harbor ice; and adverse weather conditions are apt to be less of a menace on ground fields than on seaplane bases. *Skyways*, December, 1943, pages 27, 76, 3 illus.

Weight Control in Specification Writing. Part I. John E. Ayers, Sr. Applied and tested means for effecting weight economy during the preparation of aircraft model specifications and as an integral part of the design are suggested. The sequence of subjects in the article parallels the order and breakdown set forth in the literature of the controlling agencies directing the preparation of airplane manufacturers' model specifications, and the article is offered as a checking device with which the designer may determine whether or not optimum initial weight control has been achieved. It is indicated that the larger airplanes present greater latitude for design ingenuity, although opportunities exist for weight economy in the smaller units, but it is advisable to adhere to single-purpose types of aircraft in order to achieve optimum efficiency in weight control. The advantages to be gained by making provision in the design for additional passengers, crew, or cargo are pointed out. Operational simplicity, stability, and safety should be the deciding factors.

Although it may appear paradoxical to apply weight control to the pay load of an airplane, the writer holds that such control must be written into the model specifications to insure the best balance and operational characteristics. Weight approximations are presented for crew members, day and night passengers, and cargo, including provisions, instruments, controls, accommodations, furnishings, etc., as well as the items usually classified as useful load. The writer lists some of the ways in which overall weight can be reduced, stating that the opportunities are many and advocates bold deviation from accepted practice and standard specifications if the work can be intelligently carried out. It is his opinion that, with further progress in design, it may be possible to write into the model specification weight economies up to 8 per cent of the weight of the airplane by means of practical reductions of load factors. *Aero Digest*, November, 1943, pages 251, 252, 1 illus.

Designing for Production. Part VII. James E. Thompson. The seventh in a series of articles on designing aircraft in such a way as to facilitate production carries forward the discussion of machined parts. The two types of standard milling machines are described and classified, and information is given on the kinds of work they are built to perform. Emphasis is placed on the advantages arising from designing parts so that they can be milled on standard machines by standard milling cutters. Standard milling operations are classified as side-milling, slotting, face-milling, end-milling, and keyway cutting. Each of these operations is discussed in detail. *Western Flying*, November, 1943, pages 56, 58, 60, 62, 68, 8 illus.

Designing for Maintenance. G. E. G. Lywood. A description of some of the designing work carried out by the British to facilitate the maintenance and salvage of their combat planes. It is explained that to insure attention to the maintenance aspect a field engineer attends the usual conference on the aircraft when its mock-up is completed and reviewed. The issues the field engineer concentrates on are discussed. These include the size of components, ease of dismantling, accessibility of the engine and accessories, interchangeability of components, standardization, foolproof control connections, and the maintenance of instruments. *Aviation Maintenance*, December, 1943, pages 87–89, 178, 182, 184, 188, 7 illus.

Power, Speed and Weight. W. Nichols. Methods are discussed by which the gross weight of an airplane may be determined at the beginning of a new design. Referring to earlier articles on estimating the gross weight of the fighter and the bomber, the writer states that he has had the opportunity to investigate the problem from a different angle, upon which he bases some further conclusions. Only the case of the light airplane and the trainer airplane is considered in the current article, although the method applies to all orthodox aircraft except that certain modifications are introduced for the heavier and more powerful craft. Formulas are evolved for computing the relationship of weight to the power required to achieve the desired speed. Two tables give the characteristics and calculated examples of specifications of representative light aircraft, one for British makes and one for American types. *Flight*, October 7, 1943, pages 394, 395.

Lofting Problems of Streamline Bodies. Part 19. Carter M. Hartley and Roy A. Liming. In the 19th of a series of articles on lofting techniques, a convenient variation from the use of coordinates alone is explained. This variation follows the same basic pattern and is based upon the same principles of projective geometry that have been indicated throughout the investigation, but in some respects the analytic procedures are simpler and more conveniently resolved by standard calculation routines than in the purely coordinate approach. For calculation purposes conic sections are classified in two types: (a) with at least one tangent parallel to a reference axis, or (b) with neither tangent parallel to a reference axis. Although type a curves are shown to be closely related to type b and capable of development from the b type, the large number of type a cases normally encountered in side and plan view development and also in the body plan view justifies the establishment of a special formula and set of calculation charts. These are set forth with explanatory text and drawings. The current installment concludes with the observation that the slope techniques presented parallel in every detail the

applications to the multiplicity of lofting and layout situations described in previous articles in the series. Upon the basis of the analytic derivations given in the current section, a complete system of formulas may be developed such as has been analyzed in previous articles. *Aero Digest*, November, 1943, pages 230, 232, 316, 3 illus.

A Russian View. Nikolai Polikarpov. This is an extract from a talk delivered over the Moscow radio by one of Russia's leading aircraft designers. In the talk Mr. Polikarpov gave a brief outline of his work and that of his colleagues, showing the development trends of Russian aircraft. Observations included in this article touch upon: the utilization of old aircraft types for such purposes as training, first-aid work, communications and supplies, short-range bombing, short-range reconnaissance, etc.; preference of Russian designers for air-cooled engines; improvements in armor; introduction of simpler structural materials; simplification of production processes; and the need for an aircraft capable of performing military operations at altitudes of 38,000 to 39,000 ft. *Flight*, October 21, 1943, page 453, 1 illus.

Electrical Equipment

Parallel Operation of Airplane Alternators. D. W. Exner. An auxiliary engine and alternating-current generator installation is described as an answer to the need for increased electric power in large military airplanes. The operation of the unit and its controls is explained and directions are given for the synchronization of two such alternators. Following the detailed examination of an existing a.c. installation of the type mentioned, the writer gives the requirements of a 400-cycle airplane power system that will take advantage of the experience gained and of the newer developments available. It is held that a successful system must involve parallel operation of a number of generating units and that the failure of a single unit must not shut down the whole system. The limitations of independent auxiliary prime movers are noted, and reference is made to recent developments of suitable means for driving alternators from the main engines. So-called "constant-speed" drives are credited with providing a.c. electric system prime movers of proved reliability and high-altitude performance, but various difficulties are outlined that must be overcome.

Remedies for some of the difficulties are suggested in the form of overrunning clutches, exciter systems of ample capacity, and improved voltage regulators. Means for equalizing overloads and the choice of synchronizing methods are discussed, and the advantages of automatic synchronizing apparatus are outlined. *Aero Digest*, November, 1943, pages 172–174, 298, 300, 304, 307, 308, 310, 6 illus.

The Electrical System of the P-38. Pertinent data with reference to the electrical equipment of the Lockheed Lightning are contained in this brief article. Characterized by compactness, the electrical system of this fighter plane comprises a 24-volt d.c. single-wire installation, except for the 115-volt, 400-cycle a.c. used for fluorescent lighting and the remote compass. The list of equipment electrically operated includes: the automatic oil and coolant system, intercooler actuators, starters, turbo-supercharger regulators, temperature indicators, propellers, fuel-level indicators, auxiliary fuel pumps, tachometers, remote compass, bomb and tank release, armament firing, lighting apparatus, and miscellaneous warning devices. Wiring is protected by rigid, flexible, and plastic conduits, with a marked trend toward the use of hardnesses in place of conduits to facilitate production and maintenance.

The new wiring-board technique used by Vega Aircraft for the simultaneous assembly of several "harnesses" is described, and a schematic drawing illustrates the entire electrical system under discussion. *Aero Digest*, November, 1943, pages 244, 246, 247, 5 illus.

Engines

Pre-Selected Engine Speed. A detailed description of the (British) Lockheed hydraulic system for the remote speed control of propellers. This automatic unit is designed in conformance with Air Ministry requirements that a lever in a gate or quadrant should select an exact predetermined engine speed when an aircraft was taking off, climbing, or cruising at its maximum speed, the engine r.p.m. in each case to be the maximum speed permitted by the engine manufacturers. It is credited with not only presetting engine speed in certain phases but also with controlling multiple engines in an aircraft with equal precision by means of a multilever device operated by the pilot or engineer in charge of engines on an aircraft. It also sets the propellers in a feathered position and can be used to vary the r.p.m. between the maximum and minimum cruising speeds.

According to the data, the Lockheed "slave" consists of a small unit bolted direct to the propeller governor housing. It has several pistons and springs that positively actuate a piston rod connected by a bell crank lever to the upper end of the governor spring. After passing through a rotary valve operated by the control lever, oil under pressure from the main hydraulic supply in the air craft is conducted through pipes to two ports in the slave cylinder. At one end of the slave unit are adjustable stops in an accessible group which permit a wide range of adjustment for various engine speeds for individual engines on an aircraft. A series of schematic drawings illustrates the system. *Flight*, October 28, 1943, pages 480, 481, 7 illus.

The Cirrus Minor Aero-Motor. A description of the Cirrus Minor 90-hp. aircraft engine is presented, together with data on its performance record. As used in the Taylorcraft Auster, the Cirrus Minor engine is described as a robust and simple inverted four-cylinder, in-line, air-cooled engine of conventional type, with its crankshaft running in five white-metal bearings and a thrust race at the front end. Connecting rods are of "Hiduminium" with slipper-type pistons and fully floating gudgeon pins. A tabulation of the engine's specifications accompanies the article. *The Aeroplane*, October 15, 1943, page 444, 1 illus.

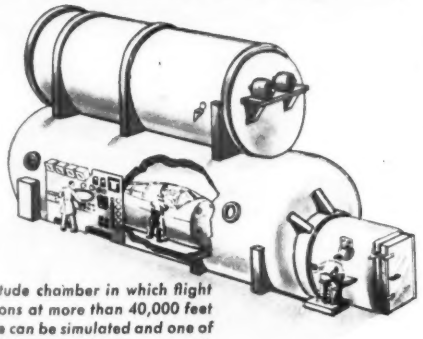
The Bristol "Hercules" Aero-Engine. A description of the Bristol Hercules XVII, based on an inspection of the engine in course of manufacture and assembly. The principal technical particulars and dimensions are listed. Reference is made to the continuous progress achieved in the design of the Hercules engine, which was introduced in 1936, and to the outstanding part it is playing in the war against the Axis. It is stated that the maximum power output at operational altitude has been increased over the initial power by more than 60 per cent. Two of the principal modern military aircraft in which this sleeve-valve radial is being installed are the Lancaster II heavy bomber and the Beaufighter. It is noted that the ability of the engine to deliver high power over long periods makes it especially suitable for long-range bombers.

The timing of the sleeve valves is shown to be simple. The steel sleeve has four especially shaped ports that are claimed to provide a better inlet and discharge coefficient than the four poppet valves used in the early Hercules engines. *The Engineer*, November 12, 1943, pages 383–385, 4 illus.

Diesels or Disasters. The failure of the United States aviation industry to employ Diesel engines for aircraft is questioned in this article. It is claimed that, in addition to eliminating fire hazards, Diesel engines reduce operating costs by obviating the fuel expenses of gasoline-powered planes and increase the relative efficiency of the aircraft. Noting the successful application of Diesel engines in European aircraft, the article charges that the development has been obscured by a smoke screen of misinformation

KEEP YOUR EYE ON

Tomorrow's Horizons



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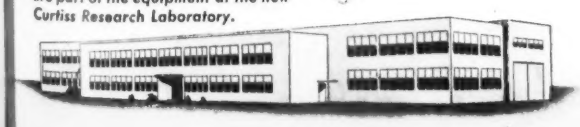

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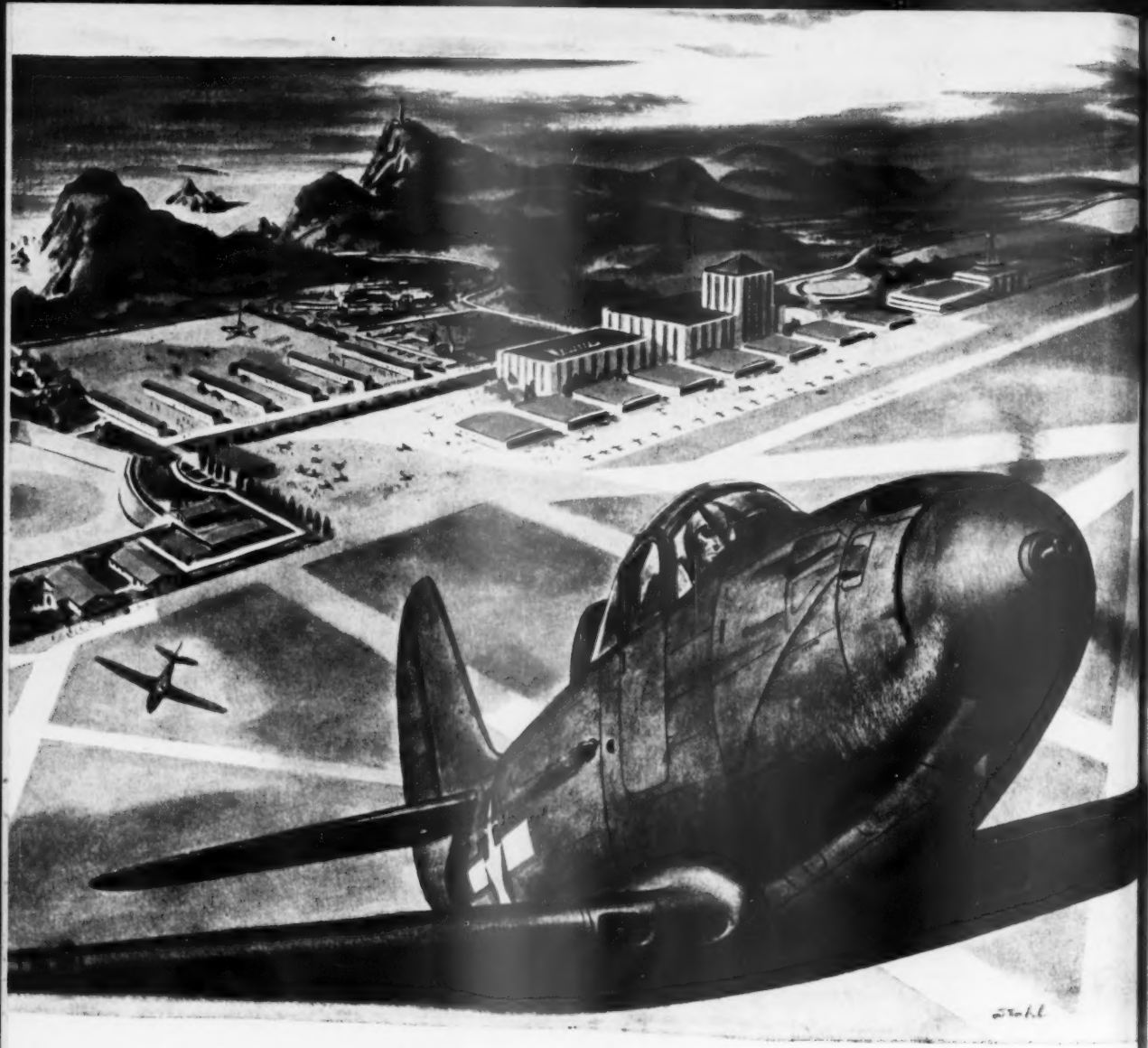

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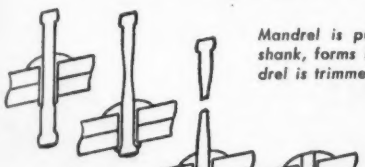

Mandrel is pulled into rivet, expands shank, forms head on blind side. Mandrel is trimmed flush.

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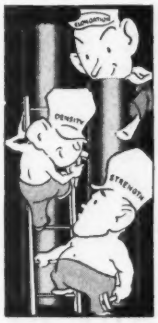

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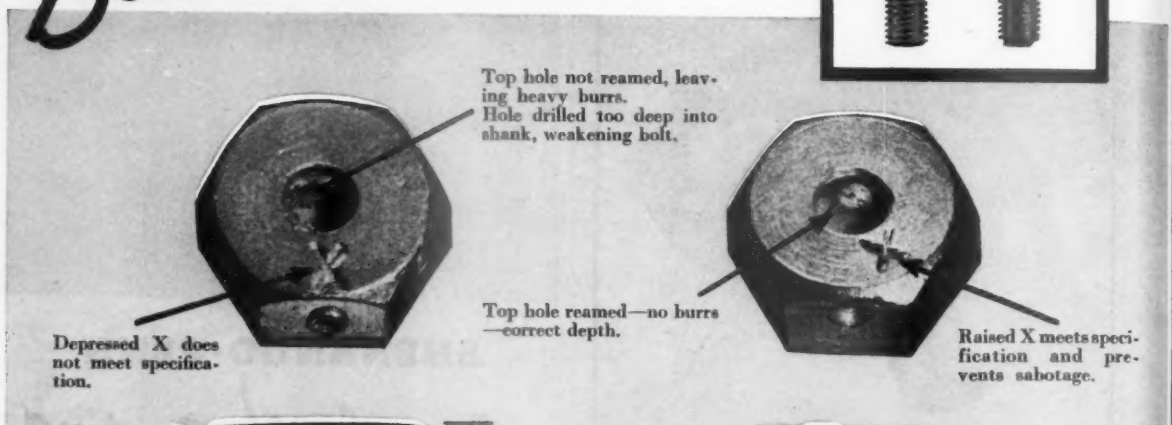
Top hole not reamed, leaving heavy burrs.
Hole drilled too deep into shank, weakening bolt.
Depressed X does not meet specification.
Top hole reamed—no burrs—correct depth.
Raised X meets specification and prevents sabotage.
Head 1/32" shallower than called for in specification.
Height of head as specified.
Burr on inside—possible obstruction to lacing wire. Location of holes irregular.
Burr on outside of hole, causing danger of cutting lacing wire.
Holes properly countersunk—clean—no burrs or obstructions.
Holes uniformly located—facilitates threading.
Not properly pointed—poor starting thread.
Properly pointed with good starting thread.

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An aircraft company in California wired us to have our representative come and look at some of the bolts they were getting—presumably from us. We looked at them, but they weren't our bolts, as the customer soon confirmed.

Unretouched photographs, greatly enlarged, only partially indicate the differences that are apparent on close inspection of the bolts themselves—one taken from the batch that caused the complaint, and one from *our* regular production.

Any engineer, production man or aircraft inspector knows that these differences are important.

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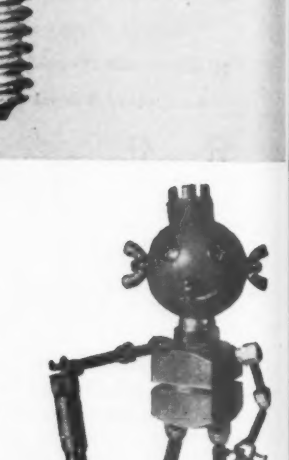

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fostered by United States aviation people. *Air News*, October, 1943, pages 14–16, 56, 7 illus.

Three German Engine Fuel Systems. In the conclusion of a two-part article on the fuel systems of three German aircraft engines, the fuel system of the BMW 801A/1 radial, air-cooled, 14-cylinder, double-row engine is examined. Sections of the article discuss the hydraulic control unit, the arrangement of the oil system in this unit, throttle control, mixture control, automatic mixture and boost change-mechanism, and the fuel injection system. *Aircraft Engineering*, October, 1943, pages 293–302, 34 illus.

The Mannerstedt Engine. From notes and pictures in the Swedish magazine, *Flyg*, information is given on the aircraft engine designed by Folke Mannerstedt, chief designer of the Swedish Husqvarna motorcycles. Incorporating many unusual features, the 42-cylinder, multirow radial M engine is divided by the propeller reduction gear into a front and a rear unit. Because the drive is taken from the center instead of from one end of a long engine, torsion in the crankshaft is said to be reduced. Each of the two units of the engines comprises three seven-cylinder radials, placed tandem to one another. The supercharger is of the two-speed, two-stage type, with intercooler. The action of the change from the lower to the higher blower gear ratio, which is accomplished by bringing a brake drum to a standstill, is described in detail. Since direct fuel injection is employed, the supercharger compresses air only.

Characteristics of the M engine are compared with those of the Rolls-Royce Vulture, and specifications of the Swedish engine are tabulated. *Flight*, October 28, 1943, pages 469–471, 4 illus.

Engine Control Achieves Simpler Piloting. William J. Morrison and A. P. Fraas. A detailed description of the development, construction, and operation of an automatic power-plant control, produced by Simmonds Aerocessories, Incorporated, under a license agreement with the British firm of Hobson & Components, Ltd. Although different models of the device vary, the controlling element in each unit is an evacuated capsule that operates a valve supplying oil to a servo piston. The servo piston, in turn, operates a member of the throttle linkage. Earlier types in the series of automatic engine controls regulated either manifold pressure or boost, but current models control both manifold pressure (boost) and mixture.

Study of the Simmonds-Hobson engine controls is broken down into consideration of the following: engine operating characteristics, function of automatic controls, automatic control of manifold pressure, automatic boost and mixture control, and advanced automatic control units. In addition to illustrations and schematic diagrams of the device, there are three graphs showing the following: specific fuel consumption and r.p.m. as function of power output for both propeller load and constant manifold pressure operation; effect of spark advance on maximum b.m.e.p. with rich mixtures for a hypothetic engine; and spark advance effect on best economy specific fuel consumption for the same engine. The latter two graphs are computed from *N.A.C.A. T.R. No. 655*. *Aviation*, November, 1943, pages 132–134, 257, 258, 299, 8 illus.

German Aero-Engine Pistons. Based on a summarized report from the British Air Ministry, the article describes metallurgic investigations of seven light-alloy pistons from German aircraft. The investigations were directed principally to determining the types of alloys in use and the general standard of quality adopted and to obtaining information relating to the methods of manufacture employed.

The pistons examined represent four engine types and an example of each type is illustrated. It is concluded that the pistons would be regarded as of good general quality, although the rather inferior microstructure of the B.M.W., Mercedes-Benz, and Jumo pistons would not be expected to be accompanied by the best properties. It seems that the German manufacturers do not consider modification of the eutectic silicon-aluminum alloy to be important and evidently permit coarser particle size than is normally considered to be acceptable. *The Engineer*, November 5, 1943, pages 363–365, 5 illus.

Flight Technique

Blind Man's Buff. William D. Strohmeier. The flight pattern and how to get into it is stated to be one of the major problems at all primary flying fields, although to experienced instructors it is a simple maneuver. The two basic problems are listed as (1) inability or failure to imagine exact or even approximate dimensions of the pattern and (2) inability to determine direction of pattern because of the usual type of short, poorly visible wind tee used. Noting that these problems are simplified at airports having tees aligned with the runways or where there are section lines and the airport is square and has straight boundaries, the writer describes conditions said to be typical of many airports and reviews the errors often made by cadets. He proceeds to outline the proper procedure, referring to a diagram and suggesting correct methods of determining the direction of the let-down area, including the use of the right hand as a direction finder. Three specific situations are exemplified. Emphasis is placed on careful planning of good traffic entry, with imagination and forethought. *Air Facts*, December, 1943, pages 28–33, 1 illus.

The Sequence; How to Fly It Properly. Part II. George R. Clay. The second of three instruction articles on how to perform properly the various maneuvers of the flight-training sequence. This article covers the rectangular course, the "S" turn across the road, the number two elementary eight, number three elementary eights, eights on pylons, and forced landings. The text is supplemented by diagrams showing how the maneuvers are executed. *Southern Flight*, November, 1943, pages 52–54, 56, 9 illus.

Power-Off Landings. Lt. (j.g.) Robert W. Duncan. Stating that the landing is the most important action taken by the average pilot with a plane in any civilian or military service, especially in the Navy, the technique of landing is discussed. The many kinds of landings are mentioned in reminiscences of the experiences of the writer while learning, and advice is given on how to make landings under a variety of conditions. *Air Facts*, December, 1943, pages 48–50.

Transition IV. Wolfgang Langewiesche. In the fourth of a series of articles, it is stated that all airplanes fly alike, that skill accumulated in handling small planes is fully applicable to the large units, but that trouble is frequently encountered in the first 20 hours after the transfer to the larger craft. Analyzing the differences, the writer shows that they are fundamentally merely the greater size, speed, and power. Speed is demonstrated to be a factor that makes the plane easier to fly, for reasons brought out in earlier articles and as amplified in the present installment. The stiffness of a fast plane presents a difficulty, which is explained. Power-off landings and power approaches are discussed at length, as well as stalls and the problems of reducing the speed from the cruising rate to a proper approach speed. *Air Facts*, December, 1943, pages 60–70.

History

Flying as it Was. Brig. Gen. F. P. Lahm. Some recollections on the first Army flights, made at Fort Myer, Va., 35 years ago. These were prescribed trial flights under conditions imposed by the Army Signal Corps when they contracted to purchase an airship from Capt. Tom Baldwin and an airplane from the Wright Brothers. . . . both aircraft to be adapted to military purposes. The writer and Lieutenants Selfridge and Foulois were the three young officers who, in accordance with the contracts, were instructed by the builders in the operation of the airship and the airplane, respectively. Early government contract requirements and Army acceptance flights are reviewed, and the part played by this pioneering work in establishing America's air power is stressed. *Air Pilot and Technician*, October, 1943, pages 6–8, 11, 40, 8 illus.

"I will"

The following was found on the flyleaf of the diary of an Iowa boy who fell at Chateau-Thierry in 1918:

"America *must* win this war. Therefore *I will* work; *I will* save; *I will* sacrifice; *I will* endure; *I will* fight cheerfully and do my utmost, *as if the issue of the whole struggle depended on me alone.*"

..."as if the issue of the whole struggle depended on me alone."

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40th Anniversary Issue. Practically the entire issue of *U. S. Air Services* for December is devoted to the 40th anniversary of the first flights in an airplane, made by the Wright Brothers. The following articles are presented:

"Our Life in Camp at Kitty Hawk," by Orville Wright; "Contributions of Wilbur and Orville Wright to Aeronautical Science," by Dr. George W. Lewis; "First Flyer in More Ways Than One," by Grover Loening; "They Gave Us a New World," by Gen. Henry H. Arnold; "Orville and Wilbur—The Immortal Brothers," by Col. T. De Witt Milling; "The Two Vital Problems of the Wright Brothers," by Maj. Gen. B. D. Foulois (Ret.); "We May See the Elimination of War," by Gen. Frank P. Lahm (Ret.); "Let Us Pause to Honor Orville and Wilbur Wright," by Glenn L. Martin; "Wrights Were Discoverers of Secret of Flight," by Thomas R. Reed; "The Wrights Solved All Fundamental Problems of Flight," by Comdr. A. F. Bonnalie; "Orville Wright is an Everlasting Inspiration to Me," by Maj. Al. Williams; "I Was Host to Wright Brothers at Kitty Hawk," by Capt. W. J. Tate; "Thus the Airplane Was Born," by J. Melville Broughton. *U. S. Air Services*, December, 1943, pages 11–30, 19 illus.

Icing

Manifold-Solenoid De-Icer Systems with Electronic Control. M. L. Taylor and W. B. Pond. This article explains the design, operation, and advantages of both the Eclipse electronic deicer control and the Eclipse manifold-solenoid deicer system. Controlling the operation of deicers to suit the icing conditions encountered, the former incorporates two principal features: One provides automatic adjustment for variations in rate of icing; the other provides automatic adjustments for variations in the type of ice encountered.

The electronic timer is described as consisting essentially of a single Type 2050 thyratron tube, a condenser and resistor combination for controlling its firing time, a Stowger-type step relay for switching the solenoid loads, and the associated relays and switches necessary for interlocking and operating the circuit.

The manifold-solenoid deicer system is reported to consist essentially of air pumps, a single spanwise suction and pressure manifold, solenoid-actuated distributor valves, pressure-type oil separator and air filters, pressure relief valves, and unloading valves. Distribution of air under pressure, provided by engine-driven vane-type air pumps to the deicer cells, is accomplished by energizing the solenoid-actuated distributor valves located at each set of deicer connections. Pressure-line losses with this system are said to be negligible because of the single spanwise manifolds. Diagrams, drawings, and photographs illustrate the deicer and control equipments. *Aviation*, November, 1943, pages 144–147, 8 illus.

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Engineering Review or the Institute of the Aeronautical Sciences.

Inspection

Scattered Radiation in Relation to X-Ray Inspection. Robert Taylor. Experiments are discussed that were undertaken to determine the sources from which external scattering of radiation might reach the film used in radiographic inspection and to what extent the film quality might thereby be affected. Improvement was sought in the degree of precision in the control of film quality through knowledge of the various paths taken by scattered radiation, as well as the steps to be taken to reduce the fogging effect to a minimum. The experimental procedure known as the pinhole method of analyzing the radiation coming from an X-ray tube and cones is described, followed by two studies utilizing the Potter-Bucky diaphragm to learn to what extent scatter might be eliminated with its use. A third study also is outlined, utilizing lead-foil intensifying screens in contact with the film, to determine to what extent scattering might be absorbed.

Having determined by these methods the sources from which forward-transmitted scatter might reach the film, the study is completed by finding the sources of backscatter. Results are summarized under four headings, from which it is concluded that in the X-ray inspection of aluminum and magnesium alloys there is present a certain percentage of scattered radiation when direct exposures are made and where the precautions outlined are disregarded. As section thickness increases, scattering increases; yet even on thin sections greatly improved results may be obtained if the recommended procedures are carried out. *Aero Digest*, November, 1943, pages 218, 220, 223, 292, 9 illus.

Radiographic Inspection of Light Alloy Castings. Robert Taylor. It is stated that an examination of the activities of aircraft plants reveals the increasing importance being placed on X-ray inspection. Deductions that may be made from the radiography of cast materials and some of the common discontinuities encountered are discussed. Defects distinguishable in X-ray negatives are listed and described in considerable detail. *Automotive and Aviation Industries*, November 15, 1943, pages 36–38, 40, 106, 6 illus.

Progress in Precision. O. J. Snider. In order to contrast the highly scientific and systematic inspection procedures of World War II with the crude and slow inspections of World War I, the writer compares the methods applied to the crankshaft of the 1918 Liberty engine with those applied to the 1943 Allison crankshaft, an aircraft crankshaft being used because it covers almost all types of measurements employed in checking machined parts.

It is stated that during the period under consideration, steel composition has not changed appreciably, and yet results obtained have improved tremendously. This progress has been due largely to more careful selection of raw materials by the transverse fatigue test and the improvements in finished heat-treatment.

Poorly controlled only a few years ago, today's heat-treatment results have been tied to finer and more definite units of measurement. Checking case depth and surface hardness through the use of better machines has contributed to uniformity and durability of the final product. Grain size is one of the items that have become more important than in 1918, fine-grain steels now being specified because of better life characteristics.

Inspections start with the forging billets and continue at frequent intervals in the fabrication of the crankshaft to the final visual and dimensional check of the finished port. *S.A.E. Journal*, December, 1943, pages 421–431 (Transactions), 36 illus.

Instrument Flying

"Down the Beam." A Naval Pilot. After a visit to a Royal Navy instrument flying school, the writer records some of his impressions of "blind" flying. Among other things, comment is made upon the speed with which the beam technique can be acquired, the low standard of instrument flying often displayed by experienced pilots, and the application of accurate instrument flight to the Navy. *Flight*, October 7, 1943, page 387.

A Practical Analysis of Instrument Flight. Edward A. Diefenhach. Stating that during the past two years the theory of instrument flight has gradually changed from an outmoded group of misconceptions to a sound, easily understood group of facts, the writer examines instrument flight in terms of contact flight in order to determine the causes of pilot errors. That there is any difference in the actual manner of controlling the airplane is held to be a fallacy inherent in some old textbooks which has been harmful to many pilots in learning to be success-

ful instrument fliers. The difference is defined fundamentally in the statement that in contact flight the attitude of the airplane is determined by visual reference to the earth, whereas in instrument flight it is determined by instrument reference to the earth.

Turning to a study of the causes of difficulties that arise while flying on instruments, they are ascribed to three basic errors: (1) failure to establish an accurate instrument reference to the ground through lack of understanding of the functions of the instruments; (2) failure to control the aircraft in the same way as in contact flight; and (3) failure to use positive control and to fly the airplane in terms of its attitude in overcoming vertigo. Each of these causes is analyzed and remedies are suggested. *Air Facts*, December, 1943, pages 52–57.

Instruments

A Thermal Anemometer for Low Velocity Flow. R. A. Seban, W. H. Hillendahl, E. J. Gallagher, and A. L. London. A description is given of a thermal anemometer for low-velocity flow, which indicates air velocities in terms of the cooling rate of a heated sphere. The calibration presented reveals an adequate consistency for velocities from 15 to 3,000 ft. per min. Beyond 100 ft. per min., free-convection effects become small and the instrument indication is substantially nondirectional because of its spherical form. Operation with transient conditions enables the use of small temperature differences, so that free-convection effects may be made small. Further, heater input need not be controlled or metered as is necessary with steady-state thermal anemometers. *Transactions of the A.S.M.E.*, November, 1943, pages 843–846, 7 illus.

The Testing of Aircraft Thermometers. R. Barrington Brock. Methods of testing thermometers installed in experimental and test aircraft are criticized from the standpoint of the crude and inaccurate tests applied in the past, and more scientific procedures are suggested. A special aircraft thermometer tester is described, originally designed to test five thermometers at one time. Refinements were made in the instrument from time to time, resulting in a design on which the details of construction and operation are given. Suggestions are made for the use of this equipment, the results of which are reported as being satisfactory. *Aircraft Engineering*, October, 1943, pages 303, 304, 5 illus.

The Pioneer Flux Gate Compass. Details are given on the Gyro Flux Gate Compass System, conceived and produced by the Eclipse-Pioneer Division of the Bendix Aviation Corporation. This device was developed to fill the need for a fast-acting, undisturbed accurate azimuth indication in flight. It is credited with providing an accurate indication of the magnetic heading of an aircraft under virtually all possible flight conditions and, in addition, to be operable within 3° of the North Pole.

The system is a remote-indicating earth induction compass and is made up of four main parts: (1) the flux gate, which is also a transmitter; (2) an electrically driven horizon gyro; (3) an amplifier; and (4) a master indicator or master compass with dial, which is located at the navigator's station. Remote indicating repeaters with dials duplicate the readings of this master indicator and are located at various stations within the airplane. A fifth unit, the remote caging control, is used to bring a tumbled gyro quickly to the vertical. Provision is reported to have been incorporated so that the compass is compensated for deviation . . . . with the result that a fully corrected magnetic heading is always indicated by the master indicator.

The article particularizes the operation of the master indicator and the routing of the power supply. Included in the illustrations is a schematic drawing of the compass system which identifies the power source, sensitive flux gate transmitter, gyro, master indicator, and remote indicating repeaters. *Aero Digest*, November, 1943, pages 152, 153, 157, 6 illus.

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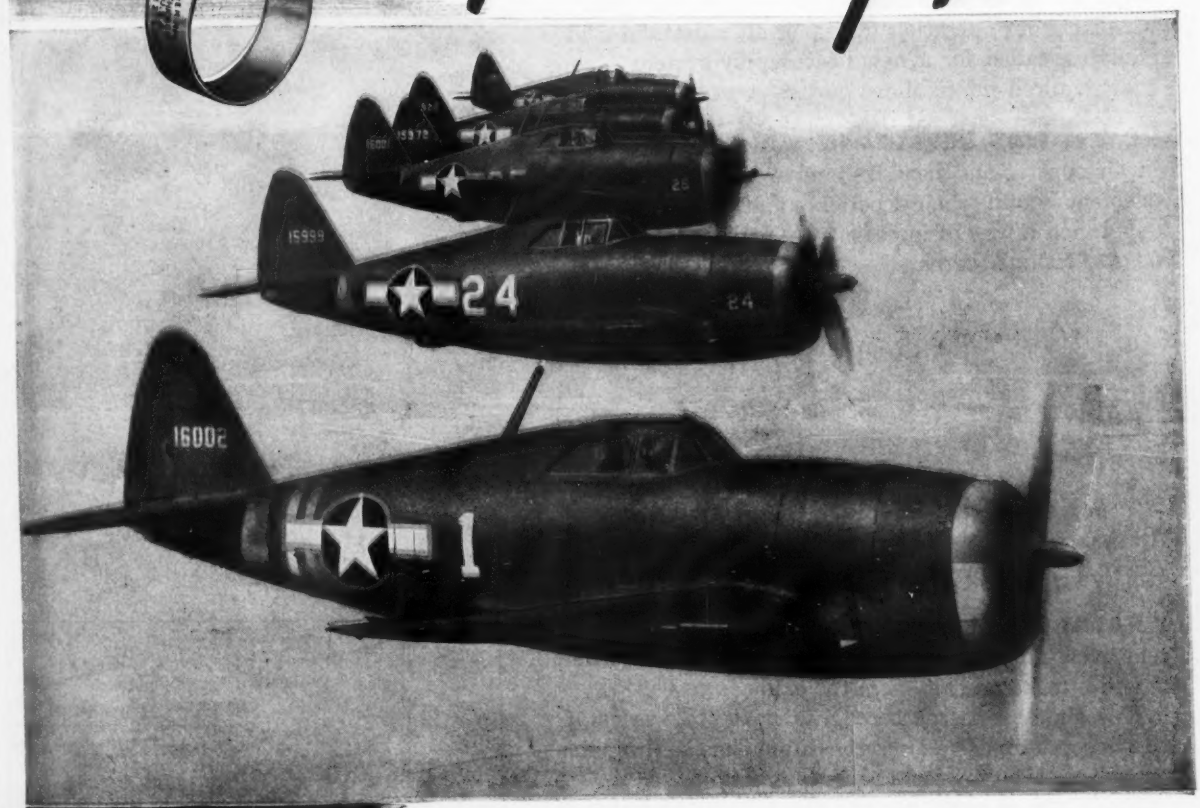

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WHAT IT DOES: As shown here, the AiResearch system ducts air from atmosphere over an exchange unit where it takes on heat from the exhaust gases.

This air then passes through a heater . . . warms air that is counter-passing into the cabin. Thus it eliminates danger of carbon monoxide contamination.

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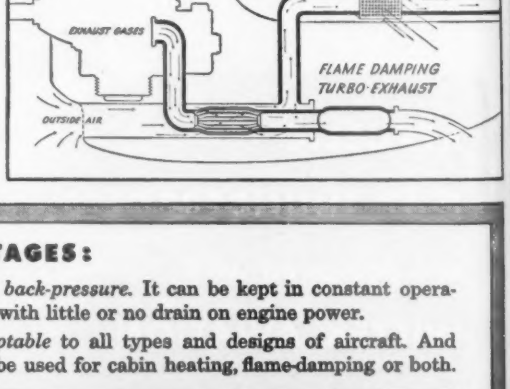

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Jet Propulsion

Thrust Without Props. Edward Yulke. The fundamental principles of jet-propelled aircraft are explained, their advantages are surveyed, and their future possibilities explored. In a comparison between the internal-combustion engine and propeller combination with what is already known about jet-propulsion arrangements for power aircraft, it is indicated that the trend for high-speed aircraft is toward jet propulsion because this type of powering is more efficient than the engine-propeller combination under certain conditions for high speeds.

Several developments already attained with jet-propulsion are noted, among them the Blohm and Voss 141-B asymmetric airplane. *Air Trails*, December, 1943, pages 22, 23, 90, 6 illus.

Lubrication

Lubricating Oil Additives as an Aid in Engine Maintenance. W. E. Kuhn. A discussion of aircraft engine oils compounded to contain a detergent for removing gummy substances from the pistons and cylinders, an antibearing-corrosion compound, and an antiwear agent. The writer considers the development of an oil possessing a maximum cleaning effect and providing maximum bearing protection. *Aviation Maintenance*, December, 1943, pages 97, 98, 4 illus.

Maintenance

Wartime Airline Maintenance. Fred Page. Maintenance methods and greater utilization of available equipment are credited with having made possible United Air Lines' record of increasing passenger-mail-express traffic and amount of miles flown in 1942, in spite of the fact that the company had 40 per cent less airplane equipment than in 1941. Comparative figures are quoted to substantiate this report and explanatory details are given on the following: (1) Through altered schedules, more time has been allowed to service planes at the termination of their trips; (2) long nonstop flights have been eliminated; (3) sleeper plane service has been discontinued for the duration; (4) the distribution of maintenance work at service stations along United's system has been improved; (5) line maintenance work has been improved through the employment of utility men and job specialists to supplement regular licensed mechanic personnel; (6) work is carefully scheduled to assure speed and efficiency at the Cheyenne base; (7) new, improved equipment and methods have been adopted both at line service stations and at the central maintenance base. *Flying*, December, 1943, pages 26, 27, 144, 4 illus.

Care and Maintenance of Turbosupercharger. R. C. Robin. This article consists of a description of the turbosupercharger and an illustrated insert on the inspection and maintenance of the Type B turbosupercharger. Sections of the insert cover preflight inspection, daily inspection, and service and maintenance. In opening the subject the writer points out that while the turbosupercharger is simple in construction it operates at high speeds and in emergencies is called on to withstand forces in excess of its design rating. Effective operation depends on the efficient functioning of all its component parts. Its ultimate life largely depends on the care exercised in its previous operation and upkeep. *Aviation Maintenance*, December, 1943, pages 62–66, 26 illus.

Foreign Service Problems. Samuel C. Timson. From his experience as a manufacturer's representative in the Far East, the writer discusses what is remiss with systems of servicing American aircraft overseas and indicates how some of the major problems can be solved by proper production and design planning at home. First, he stresses the necessity for having spare parts available when and where they are needed, citing some examples of the costly waste that has resulted because spare parts have not been adequately supplied to foreign service men in the past. Second, he demonstrates the importance of having parts for overseas shipment properly packed to include all hardware and accessories necessary for attachment. And third, he lists some of the servicing details that engineers should keep in mind when designing airplanes. Among these is the fact that, although riveting is unquestionably cheaper and faster than using nuts and bolts in production, time is often far more critical in the field than in the factory and therefore, parts particularly vulnerable to accidents should not be riveted. *Western Flying*, November, 1943, pages 38, 39, 96, 98, 3 illus.

Air Service Command Salvages Airplanes. A description of airplane salvage methods used by the Air Service Command. Information is given on methods of picking up damaged aircraft and reclaiming them. Typical salvage jobs are described. *Aviation Maintenance*, December, 1943, pages 67–73, 17 illus.

The Douglas A-20 Havoc. Features of the design, construction, and maintenance of the Douglas A-20 are reviewed, with particular reference to the service routine that is provided for keeping the plane in top condition. The article is illustrated by numerous colored diagrams and charts of the plane's major components, including the hydraulic system, nose wheel and landing gear, access and exit passages, lubrication and fuel systems, and controls. *Air Tech*, October, 1943, pages 20–27, 56, 12 illus.

Maintenance and Repair of Metal Aircraft. Joseph Lux. Suggestions are offered for the maintenance and repair of metal aircraft. Stressing the importance of design engineering to facilitate servicing, the writer goes on to present advice on the following points: inspection and analysis of damage, procedure for cleaning impaired areas, determination of strength of parts and the number and types of rivets, support of the airplane structure during repair operations, careful use of rivets, cleansing of corrosion from existing areas, materials and tools, and repairs on control surfaces. *Aero Digest*, November, 1943, pages 254, 255, 257, 258, 451, 6 illus.

U. S. Navy Maintenance. Comdr. Paul P. Blackburn, Jr. The organization that keeps Navy and Marine aircraft flying is described. It is noted that the actual repair work is done in assembly and repair shops and in the shipboard shops of the carriers and aircraft tenders. The several divisions into which the maintenance of the aircraft actually fall are mentioned. Sections of the article discuss the assembly and repair shops, training-plane overhaul, fluid control and decentralized operations, airplane modifications, and lighter-than-air craft. *Aviation Maintenance*, December, 1943, pages 51–55, 12 illus.

Servicing Hydraulic Hand Pump. Joe B. Page. Information is given on the maintenance of the hydraulic hand pump used as an auxiliary source of hydraulic power and for testing the hydraulic systems when the plane is on the ground and the power pump is not in operation. Illustrations show details of the pump, the method of checking seal interference, and how to lap the ball seat. It is explained that in installing and servicing hydraulic systems the chief troubles are caused by dirt and leakage. *Air Tech*, October, 1943, pages 28–31, 56, 6 illus.

Line Method Production of Engine Overhaul. L. Howard Flatter. This article discusses an investigation being conducted by the Maintenance Division of the Air Service Command with reference to the adoption of factory production-line technique to the teardown and build-up of engines undergoing major overhaul. It is stated that methods used by private industry offer the possibility of greatly expediting maintenance work and permitting the use of semiskilled workers. *Aviation Maintenance*, December, 1943, pages 100–103, 7 illus.

Repairing an Aileron. Information on the repair of ailerons is given for those who already have some knowledge of sheet metal work and airplane service. *Aviation Service Magazine*, November-December, 1943, pages 10–15, 24, 13 illus.

United Air Lines Maintenance. Winfield Foster. The wartime opera-

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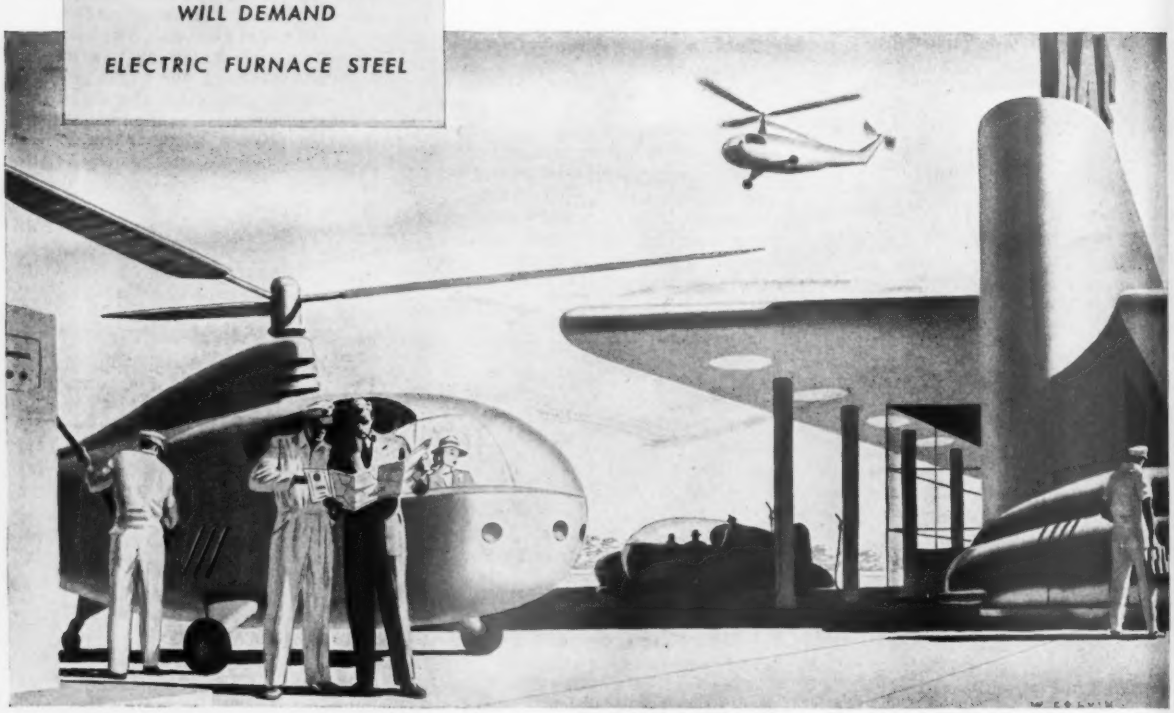

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tion of the Cheyenne, Wyo., maintenance base of United Air Lines is described. The article reveals how air lines are taking care of the greatly increased maintenance work brought about by war activities. *Air Tech*, October, 1943, pages 32–35, 69, 18 illus.

Maintenance While in Flight. How Pan American Airways' mechanics make mechanical checks and emergency repairs while clippers are in flight is explained. To portray the resourcefulness of the flight mechanic, the writer describes the underwater repair of a ripped hull caused when a Clipper ran onto an uncharted reef. Improvised diving equipment was used in making the repair. *Aviation Maintenance*, December, 1943, pages 95, 96, 192, 196, 4 illus.

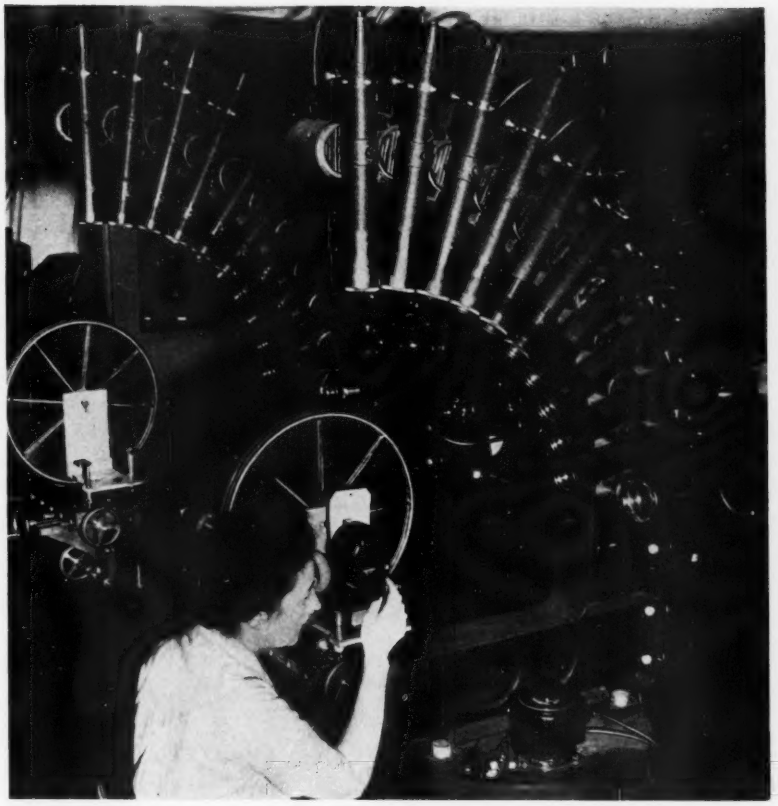
Servicing the Brakes on a Piper Cub. Al Timeter. A brief description of how to service the hydraulically operated brakes of the Piper Cub. Advice is given also on the use of the brakes, and differences between the Cub brakes and others are explained. *Aviation Service Magazine*, November-December, 1943, pages 20–22, 44, 7 illus.

Management

The Handley Page Commonwealth. Some notes on the organization and working methods of the group of firms manufacturing the Halifax heavy bomber . . . . from a press talk by Sir Frederick Handley Page. For production purposes the Halifax is divided into a small number of main components, with each major section the responsibility of a different factory. The group is reported to consist of the Handley Page parent firm and four "daughter" companies. Features and advantages of the system are reviewed. *Aeroplane*, October 29, 1943, page 505, 1 illus.

Manufacturing Equipment

Plant Power—Minus the Bottlenecks. W. D. Drummond. A system for the distribution of electric power for continuous operation and lighting in a war plant uses as an example the Wright engine plant in Ohio. It was necessary to plan the equipment for 24-hour operation and to provide against every known possibility of breakdown, sabotage, and enemy action, with the additional factor that provision was desirable for reconversion of the plant to peacetime use. Simplicity and flexibility also were important factors. Disregarding their relative importance, the points in the electrical system at which bottlenecks of reliability and flexibility are most likely to occur are listed as: primary power supply, main power supply to plant substations, primary and secondary switchgear in the plant substations, and the power and lighting transformers themselves.



This specially designed "collimator" enables the accurate checking of aircraft sextants at Bendix Aviation Corporation. Each of the radially mounted tubes contains an illuminated star-like reticle to permit accurate calibration of each sextant by obtaining precise "fixes" on the tiny simulated stars at angles ranging from 0° to 90° from the horizon.

How the system was designed and built, with provision for two sources of primary power and other means for securing the utmost reliability, is related. The apparatus, particularly the switchgear, is described in considerable detail. Illustrations include photographs of some of the apparatus and schematic diagrams of the wiring. *Aviation*, November, 1943, pages 157–159, 316, 319, 320, 10 illus.

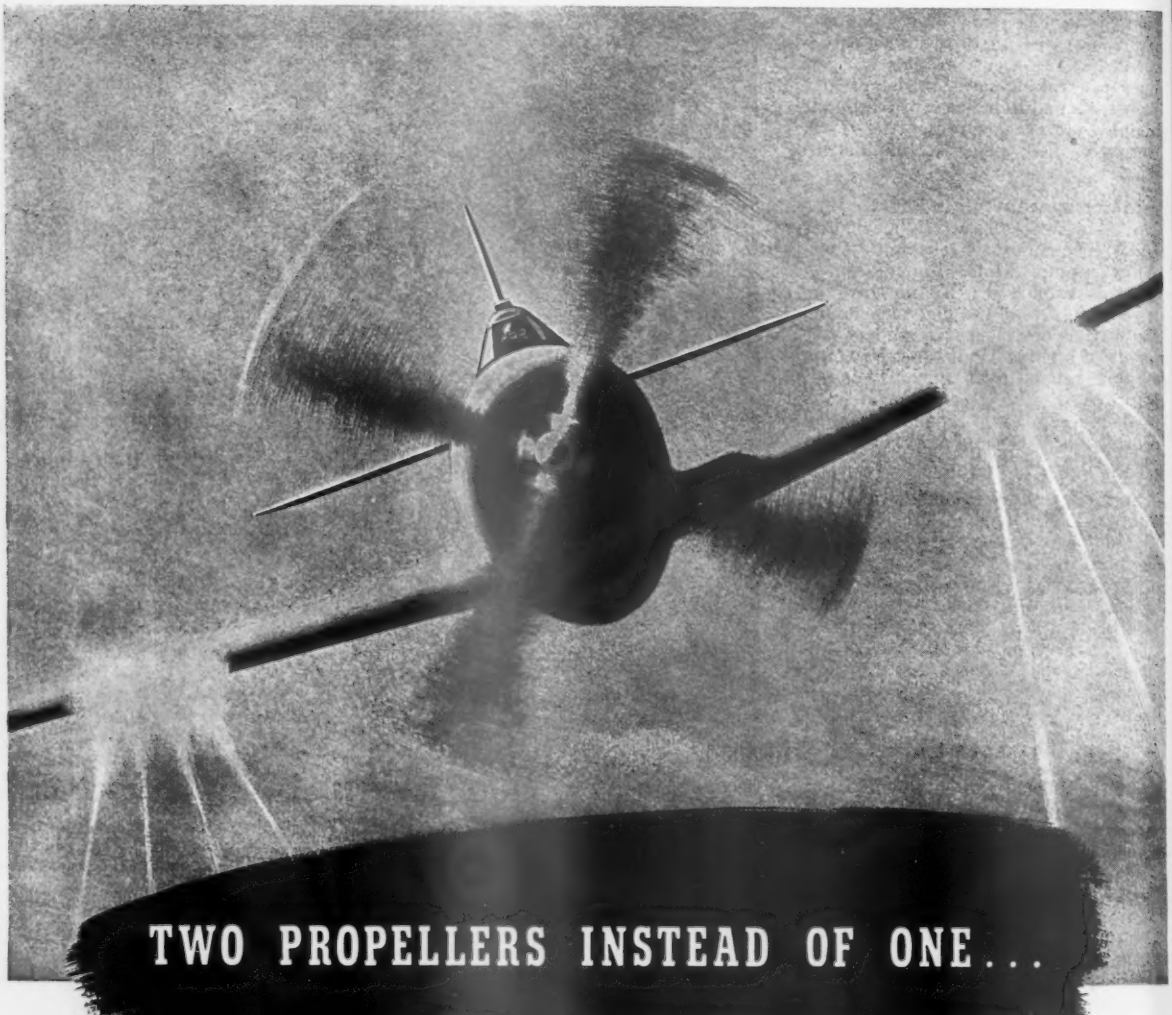
Materials

Magnesium from Sea Water. Donald H. Smith. The British method for producing magnesium from salts extracted from sea water is outlined. Consideration is given in the article to the percentages of magnesia contained in sea water, the extraction procedures, the final stages of reducing the substance to metal, and the lime preparation used for the process. *Aircraft Production*, November, 1943, pages 516, 517, 1 illus.

A Lighter Age is Coming. Magnesium alloy and its industrial applications and future possibilities, especially in the field of aviation, are discussed. The relative weights of magnesium alloy and some other metals and alloys are listed. Reference is made to a metallurgic study of two captured German airplanes in which the proportion of magnesium alloy used in the planes was determined.

It is stated that while this country has actually surpassed the Germans in the metallurgy of magnesium it has lagged behind them in its application. It is predicted that magnesium will be used in greater proportion in the metal aircraft to come. *Scientific American*, December, 1943, pages 253, 254, 2 illus.

Defective Steel. An investigation is reported in which it was found that defects in the hardness of normalized spring-steel forgings were caused by the use of damp fuel in the forging furnaces, thus decarburizing the steel's surface layers. Major points arising from the investigation are summarized as follows: (1) Erratic readings when hardness testing do not necessarily indicate that the steels are being mixed; (2) when hardness testing forgings or any hot-worked steel the use of small-indentation machines is not advisable, since only the immediate surface is tested; (3) fuels used when heating for forging must be as dry as possible; (4) for complete protection against decarburization, machining is essential; (5) decarburization contributes greatly to cracking during subsequent heat-treatment hardening processes. *Aircraft Production*, November, 1943, page 515.



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Prescriptions for Head Cracks in 24ST Rivets. E. C. Hartmann, E. P. Westcoat, and M. W. Brennecke. Laboratory tests of strengths, corrosion resistance, heat treatments, and aging of 24ST aluminum-alloy rivets to determine the effects of head cracks are reported in detail. Made by the Aluminum Company of America, these tests demonstrated that head cracks are harmless to the static strength of 24ST rivets, do not adversely affect shear fatigue strength, and do not appreciably reduce resistance to corrosion. In spite of the fact that such cracks are shown to be structurally harmless, their avoidance is advised because of their poor appearance. For this purpose, precautions are suggested with regard to heat-treating temperature, interval of room temperature aging, and sizes of driven heads. A five-point summary consolidates the conclusions resulting from the various tests. *Aviation*, November, 1943, pages 139–143, 295, 296, 9 illus.

Medicine

Repairing Air Crews. This article deals with a rehabilitation depot for Royal Air Force air crews. Reserved exclusively for noncommissioned ranks, the place is No. 2 Airmen's Convalescent Depot on the Cheshire coast, which takes serious orthopedic cases during the final stages of recovery. Information refers to the physiologic treatment of the men, their psychologic readjustment, the medical and administrative staffs, and the physical layout of the depot. *Aeroplane*, October 22, 1943, pages 467–469, 9 illus.

Syncopal Reactions During Simulated Exposure to High Altitude in Decompression Chamber. John Romano, George J. Engel, Joseph P. Webb, Eugene B. Ferris, Henry W. Ryder, and M. A. Blankenhorn. A study of syncope, or fainting, during simulated high-altitude flight conditions is summarized as follows: During 754 individual exposures of 51 human subjects to a simulated altitude of 35,000 ft., syncopal reactions occurred 91 times in 37 subjects. There were two main types of syncope: (a) the vasodepressor type (74 cases), characterized by rapid onset, progressive course, and symptoms of weakness, nausea, sweating, pallor, and hypotension, which were related to posture; (b) the nondepressor type (11 cases), characterized by recurrent and fluctuating course, flushing, and absence of signs of circulatory collapse.

Syncopal reactions occurred most often in the presence of multiple symptoms of decompression sickness. Chokes were the most frequent precipitating factor. All instances of the nondepressor type followed chokes. The vasodepressor type was precipitated by bends, chokes, or abdominal distention, alone or in combination. Involuntary hyperventilation was rarely (three times) a provoking factor of syncope in this series.

There was no correlation between a history of syncope and the occurrence of flight syncope. The tendency to repeated flight syncope could not be predicted from the first flight experience. Frequent syncopal reactions occurred in subjects susceptible to severe decompression sickness; they were complications of decompression sickness rather than indications of susceptibility to "easy fainting."

The responses of 20 subjects to tilting on a tilt table were studied 37 times before and 47 times after flight. Syncopal reactions were provoked six times by tilting after flight; in five instances there had been preceding syncope during flight, and in three postural maladaptation of the subjects was still demonstrable 2 to 7 hours later. A prolonged postflight collapse reaction is described and discussed.

It is pointed out that elimination of subjects susceptible to decompression sickness would automatically eliminate the great majority of syncopal reactions. *War Medicine*, November, 1943, pages 471–489, 2 illus.

Effect of Simulated High Altitudes on Subsequent Work Output. Lt. E. E. Foltz and A. C. Ivy. In the present war it is sometimes necessary for men to descend from moderately high altitudes, without having received oxygen while at these altitudes, and immediately engaged in violent muscular work. The investigation described was conducted because no known experiment had been performed to determine if the work output of trained subjects is affected for some time subsequent to exposure to simulated high altitudes. Details of the investigation are set forth and the conclusions drawn are presented. *War Medicine*, November, 1943, pages 471–474.

The Higher You Fly. . . Herbert S. Zim. A survey of the physiologic problems connected with high-altitude flight. Noting basic differences between military and civil aviation needs, means of solving these problems of temperature, pressure, etc., are related. *Skyways*, December, 1943, pages 30, 31, 90, 92, 97, 7 illus.

Gunners' Green Pastures. Corey Ford and Alastair MacBain. A description of a rest home established in an English manor for noncommissioned personnel of the Eighth Air Force. Reported to be the first of several similar resorts planned by the United States Air Forces, it is not a hospital but a place for revitalizing combat crews when they are in need of rest. *Collier's*, November 20, 1943, pages 16, 17, 3 illus.

The Treatment of Burns at an Army Air Forces Advanced Flying School. Major Leo R. Weinshel. With severe burns recorded as one of the more important surgical problems in the Army Air Forces, the therapy applied by the surgical service of the station hospital at Moody Field, Ga., is reported in detail. Compression bandage methods—as advocated by Allen and Koch and Siler—have been adopted. These are based upon the theory that burns should be regarded as surgical wounds and the same principles of cleansing, débridement, and rest be followed in their treatment. A description of the burn therapy room and its equipment is included in the article. *The Military Surgeon*, November, 1943, pages 389–399, 7 illus.

Metallurgy

The Metallurgy of Modern Alloys. R. H. Harrington. In this ninth installment of an article on heat-treating definitions for modern alloys, the writer continues a discussion of the role of strain relative to plastic deformation and recrystallization of solid solutions. Tables contain data on the effects of strain-induced aging on the tensile properties of various metals, and some theoretic and practical conclusions are given. *Heat Treating and Forging*, November, 1943, pages 372, 373, 1 illus.

Surface Treatments for Magnesium. Emmette R. Holman and James P. ApRoberts. The first of two articles describing and discussing the various processes and baths used for giving magnesium-alloy parts, including those used for aircraft, a protective coating to improve their corrosion resistance. In this installment the writers discuss pretreatment methods, cleaning, and chemical surface treatments. *Metals and Alloys*, November, 1943, pages 1070–1074, 3 illus.

The Specification of Steel. Greswold Van Dyke. The subject of specifying steels on a performance basis rather than on a chemical analysis basis is discussed. The Jominey test for hardenability is described and its advantages are outlined. *Heat Treating and Forging*, November, 1943, pages 574, 575, 591, 592, 2 illus.

Orientation in Low-Carbon Deep Drawing Steel. James K. Stanley. The phenomenon of orientation in low-carbon steel is considered. Sections cover the cold-rolling orientation, recrystallization orientation, the destruction of orientation by cooling from above the critical, and the hot-rolling orientation. The theory of the method used for the measurement of magnetic torque is given in an appendix. It is concluded that the magnetic torque method does not add any new knowledge on the nature of hot-rolling orientations other than to indicate that complex orientations are produced. *Heat Treating and Forging*, November, 1943, pages 578–583, 598, 5 illus.

Meteorology

Airline Meteorologist—Threefold Job. C. E. Buell. A description of how the air-line meteorologist works intimately with the pilot and dispatcher, developing his forecast to fit

Pertinent Facts About the Ram-Operated,

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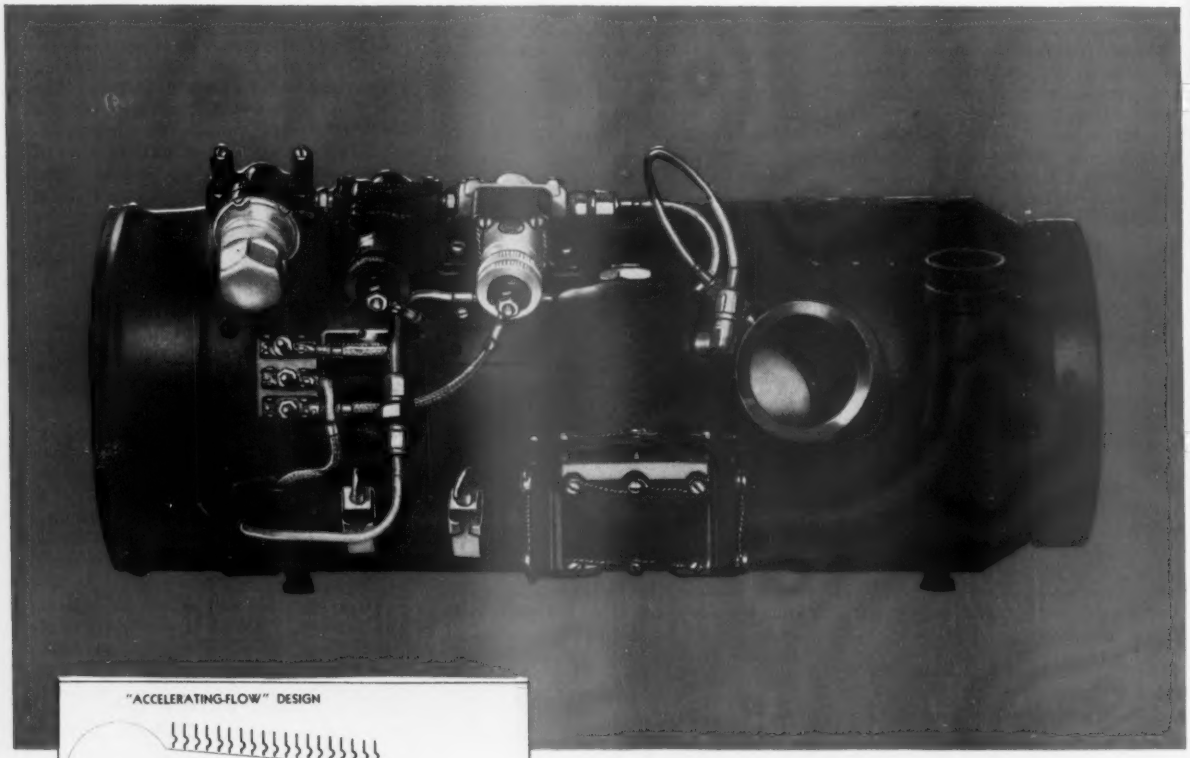
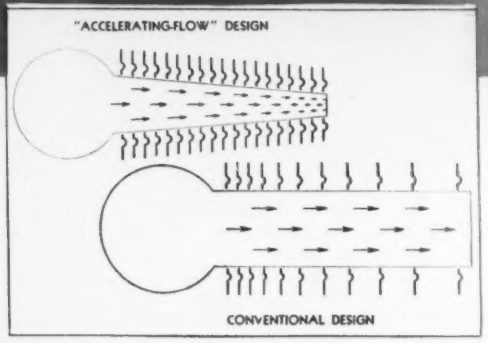
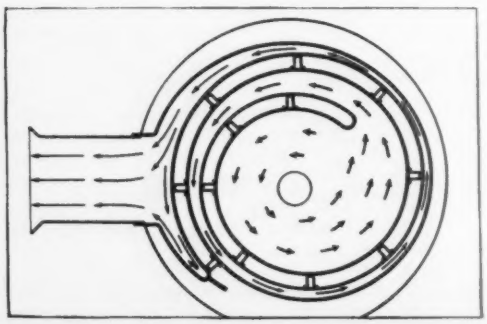




Model 906A South Wind employs new "accelerating flow" spiral design to deliver 50,000 BTU/hr. Although very sturdily built, weight is only 17 pounds, complete with controls shown.



"Accelerating Flow," as shown in these diagrams, spreads the distribution of heat more evenly over the entire surface of the heat exchanger. The spiral shape permits a maximum of heat transfer within a minimum of required space and weight.

Injection Type, Model 906

South Wind Heater

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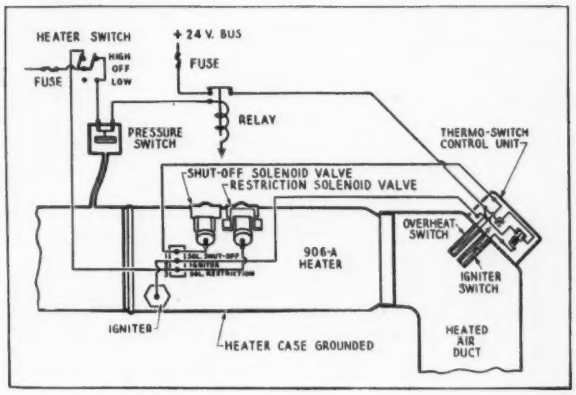
4. Its low ventilating air pressure drop (less than 2¼ inches of water with 180 c.f.m. of standard air, sea level, 50,000 BTU/hr.) permits a smaller, lighter duct system.

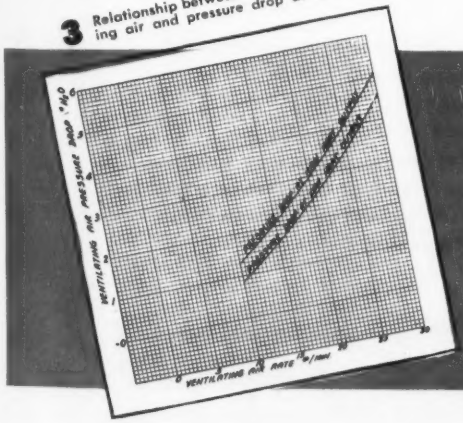
5. It requires a minimum of maintenance.

We have ready for you a manual providing detailed information regarding the performance, specifications, installation and operation of this heater. Ask us for the "Model 906 South Wind Heater Manual."

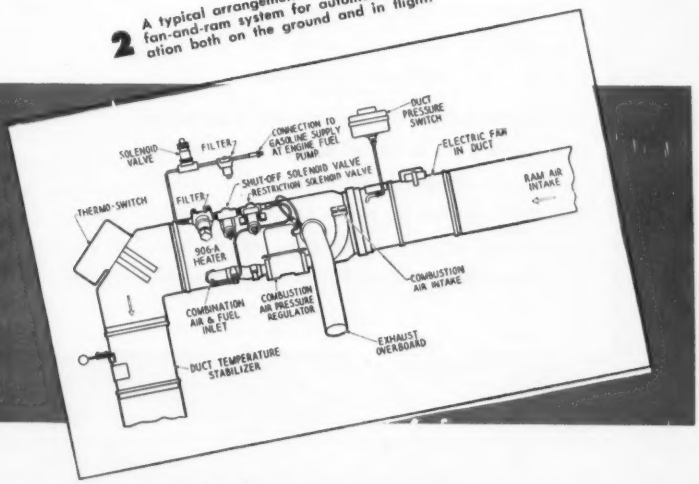
1 Electrical wiring diagram showing a typical use of the South Wind Duct Pressure Switch and Thermo Switch Control.



3 Relationship between the flow of ventilating air and pressure drop at sea level.



2 A typical arrangement of a combination fan-and-ram system for automatic operation both on the ground and in flight.



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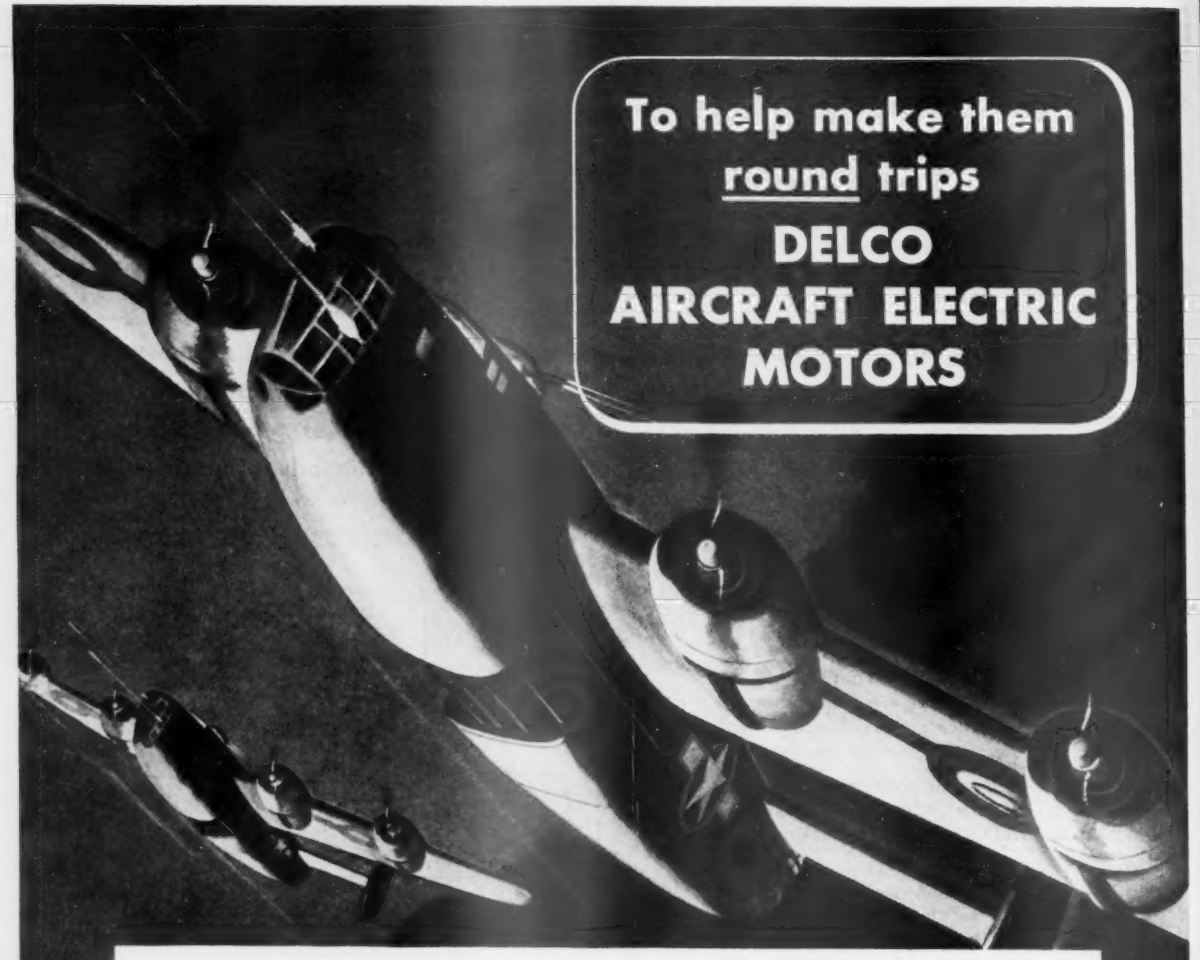

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the needs of the operation. Changes in present air-line meteorologic organizations which may follow the postwar expansion of air lines are discussed. *Air Transport*, November, 1943, pages 37–40, 5 illus.

Thunderstroms. Part III. Robert N. Buck. In the third of a series of articles on thunderstorms and how to fly through them, the types of storm are classified into four groups, according to their causes, as follows: (1) air mass—caused by heating; (2) frontal—warm fronts, cold fronts, and occluded fronts; (3) orographic—when wind lifts the air up a mountain slope; (4) convergence—two winds of opposite direction meet head on. Each of these types of storm is discussed in considerable detail, with advice on how to handle an airplane under the conditions depicted and comments on the limitations of the information to be obtained from the weather man. *Air Facts*, December, 1943, pages 20–26.

Look to Weather Elements for Successful Flight. Part II. E. J. Minser. The continuation of an article describing how weather elements affect flight and outlining the methods by which these elements may be utilized, avoided, or overcome. In this second installment the writer discusses showers and squalls and tells how the pilot may avoid ice and turbulence hazards. *Air Transport*, November, 1943, pages 57–61, 2 illus.

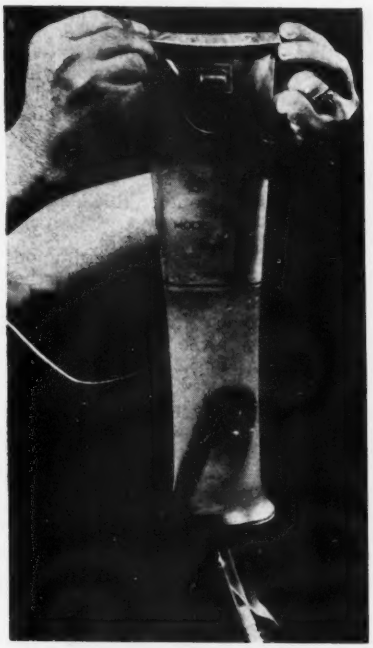
Military Aviation

Russian System of Fighter Tactics. The system of fighter escort tactics developed by Lt. Col. A. Semyenov of the Soviet Union is described.

How fighter regiments in the Soviet Air Force protect their bomber charges is outlined. The method of coordinating the joint action of bombers and fighters is explained. *U. S. Air Services*, November, 1943, page 40.

The Camels Came. Fougueux. Desert exploits of Fairey Albacores, flown by Fleet Air Arm pilots at El Alamein, are reviewed. It is described how the mastery of dead reckoning navigation required for naval flying was applied to desert strategy. *The Aeroplane*, October 8, 1943, pages 414, 415, 4 illus.

Air War on Transport. V. L. Gruberg. Combined operations of Allied air forces and guerillas against the marshalling yards, communication centers, railway, and inland-waterway systems of the Germans are reviewed. In addition to the destruction caused by strategic bombing, the effects of low-level daylight attacks against single trains and locomotives, and the damage done to German rolling stock by the Russian winter weather are considered. The importance of these transport systems and the effects of their loss upon Germany's war efficiency are analyzed. It is indicated also how German transport targets in southeastern Europe will be endangered further by Allied control of air bases in Italy. *Flight*, October 7, 1943, pages 399–401, 4 illus.



The Permutit sea water desalting bag. Chemical desalting takes place as a special briquet breaks up and converts dissolved salt into filterable sediment. (*See* page 167.)

The Eighth Came Back. Forrest Davis. **The Results Are Impressive.** Edgar Snow. A two-part article. The portion written by Mr. Davis traces the development of operations of the United States 8th Air Force Bomber Command in Britain. Contrast is offered by the report of conditions during March, 1943—when, it is claimed, the 8th Air Force faced extinction because of losses and lack of replacements—and present operations in which, with doctrines of precision bombing being successfully applied, the 8th Air Force now sends routine missions of 300 bombers against Germany.

In the section of the article written by Mr. Snow, the results of the strategic bombing operations being carried on by the R.A.F. and the U.S.A.-A.F. are reported. Analyzing conflicting estimates of the damage done to Germany thus far, he summarizes the effects of the "air war" on German production. Comments with regard to future Allied strategy and German defense tactics are also included. *Saturday Evening Post*, November 13, 1943, pages 20, 21, 92, 93, 94, 109, 110, 4 illus.

Masefield Looks at American Aviation. Peter Masefield. A series of comments by a visiting British aviation writer on aircraft production, training, and development in the United States. His general remarks are highly commendatory. His more specific impressions deal with: features of the North American Mustang, Lockheed Lightning, Consolidated Liberator, and Sikorsky helicopter; the labor problem; two types of production line which predominate in America; and the production job being done by Consolidated Vultee, North American Aviation, and Republic Aviation. *Skyways*, December, 1943, pages 35, 94.

Model Airplanes

Modeling AAF Equipment. Brian Hedges. An account of how scale models, built by engineers of the Matériel Command's miscellaneous equipment branch at Wright Field, facilitate the design planning of aircraft and the development of new tools and hangar layouts. Several of the men active in the model-building program, as well as the tools and materials used for it, are noted. *Flying*, December, 1943, pages 58, 59, 104, 108, 3 illus.

Naval Aviation

The Power and the Glory. Lt. Comdr. B. J. Hurren. A discussion of the importance of aircraft carriers in which the writer indicates that future control of the world's seaways and of world peace can be held jointly by Britain and America through armadas of sea-going air power. He reviews several statements emanating from America which show that the United States is developing a new sea power by means of aircraft carriers and naval aircraft. Although he points out that no comparable statements have been forthcoming from official British sources, it is his conclusion that Great Britain has probably been similarly engaged but is not propagandizing the fact.

The writer also urges that the Fleet Air Arm operate a fleet of cargo aircraft in support of British sea power. In his opinion such a fleet would be of high strategic value in establishing the basis for future commercial air routes. *Flight*, October 14, 1943, pages 415–419, 8 illus.

Catafighting Fools. J. I. Waddington. The article tells of the evolution of ship-based fighter aircraft as used by the British Merchant Service Fighter Unit and the Fleet Air Arm of the Royal Navy. The exploits of catapult-launched Hurricane fighters against German long-range bombers are reviewed, these successes having led to the development of special auxiliary aircraft carriers and the relatively small aircraft carriers converted from merchant ships.

The article tells how the type of airplane and its armament were selected, as well as how problems—such as the development of catapults able to produce the necessary take-off speed, the training of pilots and other personnel, and other operating difficulties, including safe return of the airplane to the small carrier—were overcome. Various British sea fighter airplanes

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Other services performed by the auxiliary carriers are listed as ferrying military planes, carrying fully-fueled craft to within flying range of combat areas, contributing toward intercepting German bombers at sea, and helping to reduce the submarine menace. *Aircraft Age*, December, 1943, pages 26, 27, 60, 61, 6 illus.

Invasion by Wrens. Based upon visits to Royal Navy airdromes, the extent to which members of the Women's Royal Naval Service are replacing men in the Fleet Air Arm is indicated. Among the duties of the Wrens, some of which are described, are those of photographic assistants, supply assistants, parachute packers, radio mechanics, and armorers. It is reported also that Wren Ordnance and Electrical Mechanics are expected to supplement this list. Of particular note is an emergency airdrome entirely staffed by Wrens. *The Aeroplane*, October 15, 1943, pages 442, 443, 4 illus.

Range of Future Planes May Make Carrier Obsolete After World War II. Blaine Stubblefield. An article predicting that postwar military landplanes will have a range sufficient to eliminate the need for aircraft carriers tells how the United States is planning the construction of three 45,000-ton carriers to speed the invasion of Japan. It is stated that the new carriers, designated CVB, will be the first designed to launch and receive twin-engined bombers. *Aviation News*, November 8, 1943, page 11, 1 illus.

The Fleet Air Arm. Arthur Bryant. Reproduction of a broadcast talk in which the history and deeds of the Fleet Air Arm are outlined briefly. Four events are highlighted—the transferral of the Fleet Air Arm from the R.A.F. to the Royal Navy in 1939; the defeat inflicted upon the Italian battle fleet at Taranto in November, 1940; the protection given to Malta and Russian convoys in the autumn of 1942; and the initiation of the use of auxiliary aircraft carriers. *The Aeroplane*, October 29, 1943, pages 498, 499, 4 illus.

The Air Marines. Curtis Fuller. A general article on the air arm of the U.S. Marine Corps. The information presented about the flying Marines includes data relative to their numbers, organization, relationship to the Navy, history, achievements, equipment, training schools, air stations, and special groups. Among the latter are glider troops, parachutists, air transport organizations, and women reservists. *Flying*, December, 1943, pages 21, 22, 190, 191, 2 illus.

Paints and Coatings

Recovery of Paint Overspray. S. Donald Perlman. Listing the estimated quantities of ingredients which can be saved through a cooperative paint conservation program on the part of the paint manufacturing industry and its consumers, the writer advises some general procedures for the handling of paint overspray and for the use of paint-overspray agents. He outlines overspray recovery processes as falling into three general classifications: one adapted to lacquers; another, to oil base and straight alkyd composition; and a third for urea-formaldehyde finishes. The following principles are suggested in the use of overspray recover agents: (1) Use the minimum amount necessary to keep the spray booth system clean and to yield a reclaimable material. (2) Keep a record of additions of compound and of the alkalinity of the water. (3) These data should be tied in with the removal of the various lots of overspray, the purpose being to enable the reclaimer to trace the causes for improvement or impairment of the quality of the overspray from lot to lot. *Aero Digest*, November, 1943, pages 269, 280, 1 illus.

Paint, Enamel, Varnish and Laquer Finishes. The first section of a review of the various types of surface finish for aircraft, and the functions they perform, gives definitions of component ingredients, descriptions of each kind of finish, and specific special applications. The materials are classified into six groups, including pigments, film-base compounds, solvents, driers, diluents, and plasticizers. Paint, varnish, enamel, lacquer, and miscellaneous finishes are defined, and suggestions are offered for the proper kind of finish to apply to 14 listed applications. Future articles in the series will review in detail other finish items such as dopes, thinners, plasticizers, etc. *Air Transport*, November, 1943, pages 62, 63.

Parachutes

RAF Life Savers. I. R. Gleed. An article on the utilization of parachutes by the Royal Air Force. Brief information is given relative to parachute types, servicing, speeds, and operation; Britain's Caterpillar Club parachute experiences of individual R.A.F. pilots; and the employment of paratroops by various countries. *Flying*, December, 1943, pages 75, 76, 126, 130, 4 illus.

Personalities

Billion-Dollar Plane Builder. Alva Johnston. Second of two biographic articles on Donald W. Douglas. Hailing Douglas as the pioneer of the airplane-manufacturing business in Southern California, this one reviews his early struggles to establish the Douglas Aircraft Company, Inc., and to run it on the proverbial "shoestring," the first decade of the company's history when Douglas built only Service planes, and the obtaining of contracts for commercial airliners

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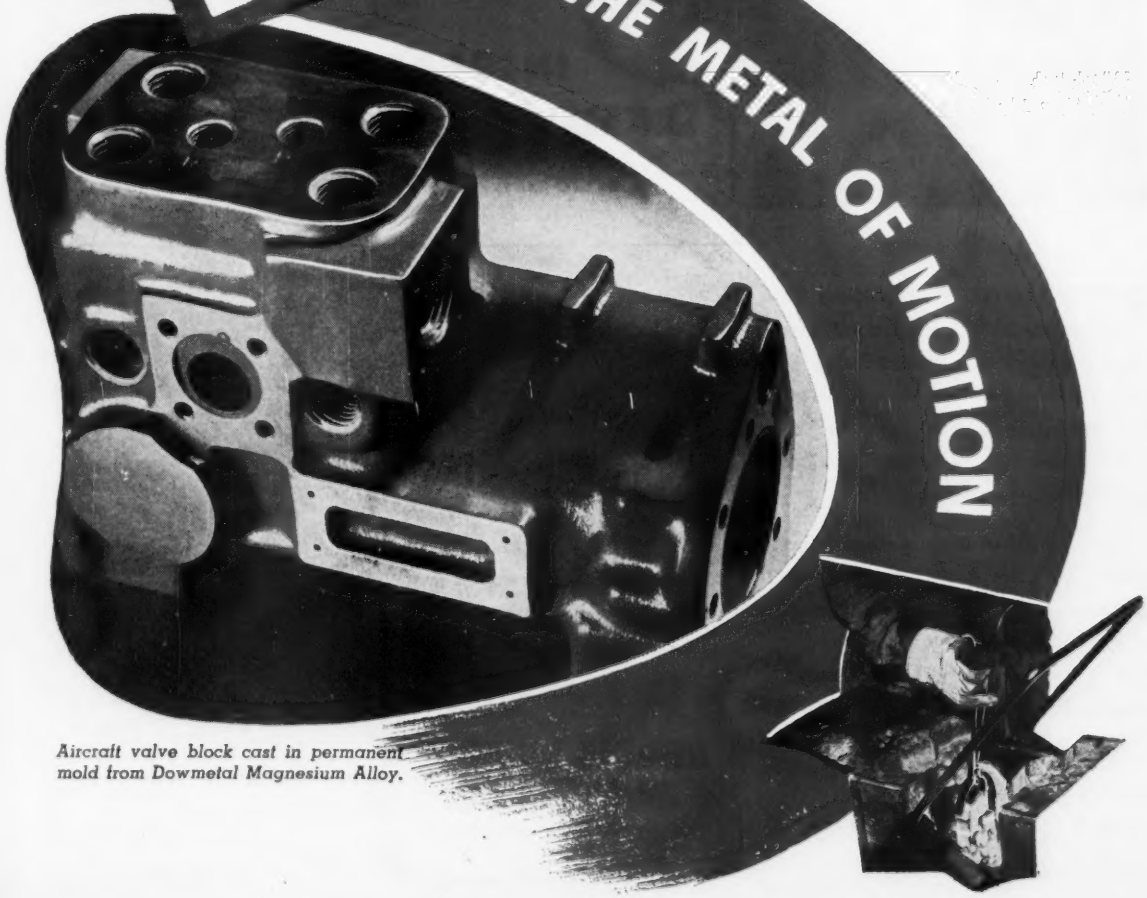

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in 1932. It also records the expansion of the company Douglas' efforts toward war preparedness for the United States, his building of the DB-7, his sale of planes to foreign countries with its consequent facilitation of the United States war production, and some of the plans in store for the Southern California industry which he fathered. *Saturday Evening Post*, December, 1943, pages 22, 62, 65, 67, 68, 2 illus.

The Passionate Engineer. A biographic sketch of Donald W. Douglas, described as the man who heads the company that built, in 1942, one-sixth (by weight) of all the airplanes manufactured in the United States. The article tells how he lives, the way he works, and what he is accomplishing in the field of aviation. *Time*, November 22, 1943, pages 77–80, 82, 84, 4 illus.

Russian Aircraft Designers. V. L. Gruberg. This article is concerned with the histories of three Russian aircraft designers—Alexander Yakovlev, A. N. Tupolev, and Sergey Ilyushin. In addition to presenting some biographic data on the three men, reviewing their achievements, and noting the honors that have been bestowed upon them, it marks the type of aircraft with which their designs have been mainly associated. *Flight*, October 14, 1943, pages 425, 426, 3 illus.

One-Man Airline. Edward Churchill. A character sketch with some biographic data on (Raymond James) "Barney" Barbin, veteran pilot and record-breaker, who is now flying a Liberator Express for Consolidated Vultee interplant transport. Barbin's activities have been widely diversified including among others the "selling" of aviation, flight training, test piloting, participation in the development of instrument flying, and the establishment of an instruction technique from which was devised an instructors' manual with correct standard nomenclature. *Southern Flight*, November, 1943, pages 28, 29, 58, 3 illus.

Ahead of His Time. George R. Reiss. The second of two articles on the aeronautical career of William B. Stout. This one follows him in his aviation developments from the end of the previous war to the present time . . . . through his association with the Stout Engineering Laboratories, Stout Metal Airplane Company, Stout Metal Airplane Division of the Ford Motor Company, the Stout Air Lines, and the revival of the Stout Engineering Laboratories. Among the aircraft innovations which it describes him as having fathered are a two-engined, all-metal torpedo plane for the U.S. Navy, the Stout Air Sedan, the Maiden Detroit Air Pullman, the Ford trimotor plane, and the Sky Car. His designs for airplanes of the future are discussed. *Air Trails*, December, 1943, pages 32, 33, 96–101, 4 illus.

Personnel

Laboratory Ladies. Phyllis Candee. A survey of the work being done by women test engineers at Consolidated Vultee Aircraft Corporation. Although none of these 17 women have an engineering degree, they are trained in physics, chemistry, mathematics, or other basic sciences pertinent to laboratory testing and are now engaged in making experimental planes.

The specific tasks and something of the background of each woman are related. *Flying*, December, 1943, pages 56, 57, 130, 136, 3 illus.

Photography

Superspeed Mapping Puts Our Flyers Ahead. The tri-metrogram photographic process for aerial mapping, used by the Army Air Forces, is described. It is explained that the process, which was named for the lenses in the three-camera unit with which the master photographs are made, is so simplified that one airman can photograph 20,000 sq. miles in less than half a day. A step-by-step description of how aerial maps are made is furnished. *Popular Science*, January, 1944, pages 68–72, 188, 192, 194, 16 illus.

Plastics and Plywood

Use of Wood in Aircraft Design and Construction. Part I. J. J. Wallace. In the first section of a two-part article the development of wood construction for aircraft is traced, and the advantages and disadvantages of the material are discussed with particular reference to the shear strength of plywood. The writer expresses the opinion that this is the most favorable property, suggesting that before a wood-airplane design is begun the following investigations be made: (1) a study of all available detailed technical data on wood aircraft construction; (2) a study of the best techniques applied in other fields, such as boats and furniture; (3) a study of structural weights of planes covered in the first point, to gather enough evidence to reveal that a wooden plane would probably be no lighter than if made of metal. He states that identical airplanes designed by three independent designers of equal talent, using steel, wood, and aluminum, respectively, would result in the steel craft being the lightest (if fabric covering were used), the wood craft the fastest and heaviest, and the aluminum-alloy plane the best compromise and most practical for production.

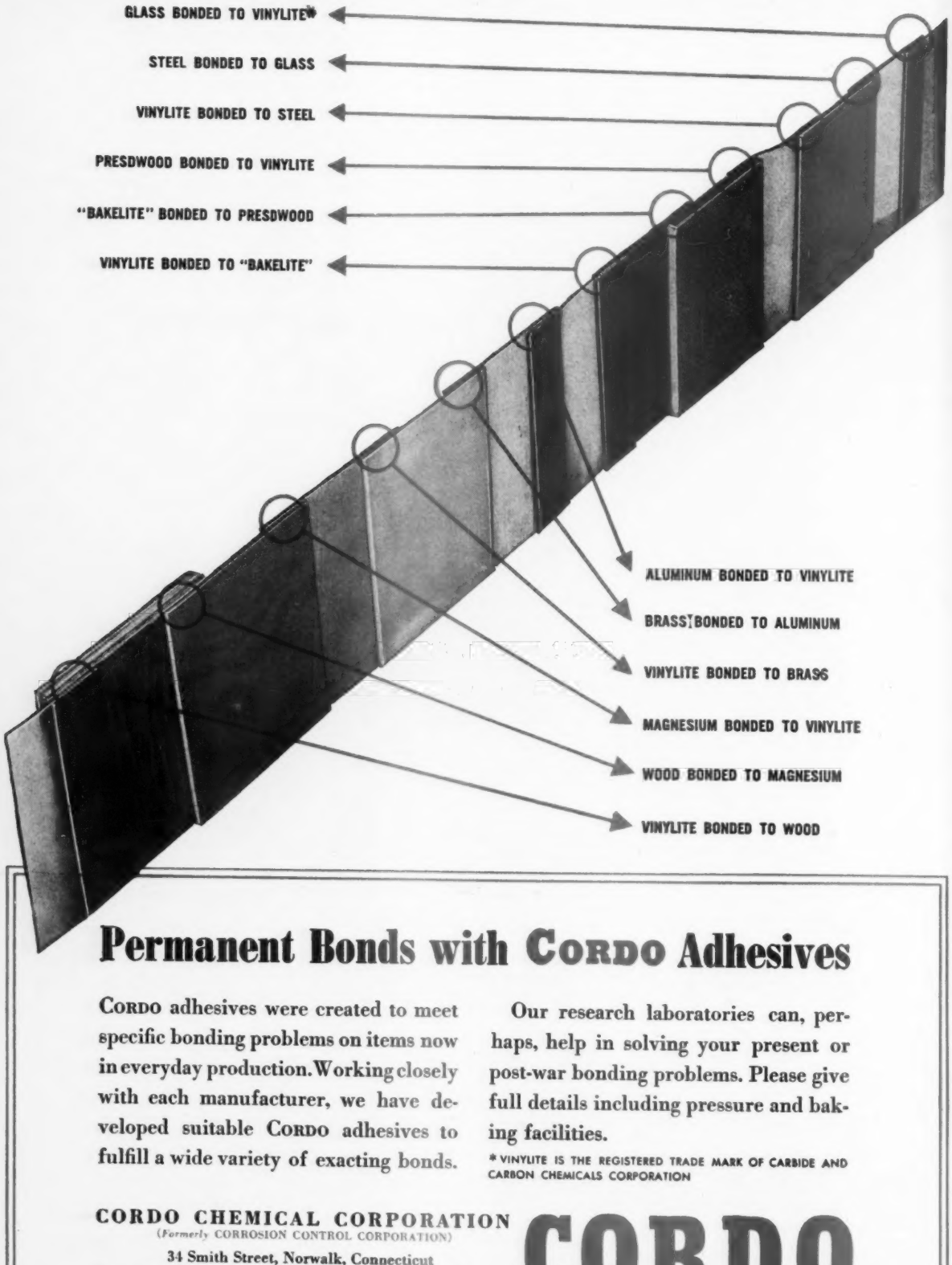
A detailed discussion follows of the application of wood to specific design and construction problems, covering the wings, plywood gasoline tanks, fastening methods and fittings, point of view and background of the designer, structural forms, and the applications of wood to individual components. *Aero Digest*, November, 1943, pages 190, 191, 284, 288, 290, 10 illus.

Resin Impregnation of Wood. Ralph Casselman. The association of wood with synthetic resins is credited as one of the most important factors in the reinstatement of wood as a modern material of many uses and a future material of many more, with the possibility that impregnation is one of the outstanding contributions. By impregnation an effort is made to overcome certain limitations of natural wood or to develop properties so different as to be considered new.

The process is briefly reviewed and materials known as "Impreg" and "Compreg" are defined. The contributions of resin to the properties of wood are outlined under the following headings showing what resin does for wood. It plasticizes or softens wood for compression; holds the plies of veneer together; bonds the fibers; interferes with the rate of moisture absorption and penetration; should have a real effect on the ultimate properties of the wood; increases the hardness and, to some extent, the compressive strength of the wood; usually tends to embrittle the wood; improves wood's resistance to decay and termite attack. Phenol resins, at least, increase wood's resistance to acids.

The types of resins used in Compreg and Impreg are described, with tabulated data on treated woods of various kinds, and the applications of these products are discussed. *Modern Plastics*, November, 1943, pages 124–126, 168, 3 illus.; *Mechanical Engineering*, October, 1943, pages 737, 738, 744.

Wood in Aircraft Construction. A brief summary of the purpose and functions of the Advisory Panel on the Application of Wood in Aircraft Construction set up by the British Ministry of Aircraft Production. The Panel will advise the M.A.P. on all matters relative to the use of wood in aircraft, with the following objectives: (1) improving the quality of wooden aircraft and components; (2) aiding production by technical improvement of processes; (3) making the most effective use of available timber; (4) improving the quality of glues. To do this, it will examine problems of wood construction technique which confront the aircraft industry, consider research and development now continuing both in official laboratories and at firms' works and advise about priority and the need for sponsoring further research and development, and arrange for making technical information available to members and firms represented. *Flight*, October 21, 1943, page 448, 1 illus.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Industrial Applications of Phenolic Resins. The history of the establishment of the Plastic Tooling Division at the Curtiss-Wright Buffalo plant is reviewed in an account of the application of phenolic resins to the making of tools. After telling of the difficulties that were overcome in the development of deep-drawing processes, a typical example is given of the use of plastic punches in the making of the air scoop in the cooling cowl of the P-40 Warhawk. Similar methods are now being used in the production of larger units such as cowl skins for the Commando transport plant. A further step in the application of this method was the production of the "transition skin" for the Commando fuselage, formerly made on power hammers requiring 4 hours per skin. The use of the stretch press to form this part in 15 min. is described, and it is estimated that when production methods are perfected it will be possible to reduce the time to approximately 3 min.

In addition to the use in actual forming production, it is indicated that there is still another adaptation of the phenolic resins where they serve as an adjunct to production, this being the use of plating shields of this material to speed output of chromium-plated parts in the Electroplating Department. It is stated that a time reduction of 76 per cent over the former method of preparing the work for plating has been accomplished. Examples are given of the use of this method on shields for landing-gear struts and for small plastic-plating shields that combine electrodes with the plastic receiving form.

It is stated that the largest structural thermosetting plastic casting yet produced is indicative of the scope of applications for thermosetting resins. This is the large experimental trunnion plate forming the center panel section of the Commando, the specifications for which are given. This plastic casting measures 13 ft. long, 3 ft. 4 in. high, and 10 in. thick and weighs slightly under 1,000 lbs. Although the casting made did not conform to the requirements of the optimum trunnion plate, the results obtained under the adverse production conditions are held to have been gratifying, indicating the advanced state of the company's plastic program and demonstrating that thermosetting plastics may be handled in bulk where proper facilities and techniques are available. *Modern Plastics*, November, 1943, pages 84–88, 166, 188, 14 illus.

An Outline of Wooden Construction. John A. Sizer. First of three articles tracing the development of wooden aircraft construction. Starting with the use of bamboo, this installment tells how plywood came to be employed and reviews its early applications in different countries. It then goes on to describe the introduction of stressed-plywood skins and

the onset of rigging. In conclusion, it covers the splicing of spruce spars and brings the history up to the design of the Handasyde H.2 monoplane of 1922, which had one of the first thick completely plywood-covered monoplane wings in England and is designated as probably the first British airplane with a multispar wing. *The Aeroplane*, October 8, 1943, pages 418–421, 17 illus.

An Outline of Wooden Construction —II. John A. Sizer. Second of three articles on the history of wooden aircraft construction. Part two is concerned mainly with reviewing the development of wood construction in its application to fuselages. The names of several British and German companies are mentioned in connection with their contributions to the design progress of wooden airplanes. *The Aeroplane*, October 15, 1943, pages 440, 441, 11 illus.

An Outline of Wooden Construction —III. John A. Sizer. Conclusion of a three-part article outlining the development of wooden aircraft construction. This installment is concerned primarily with the employment of wood in the construction of flying-boat hulls and in the construction of tail units. Airplanes are mentioned which typify wooden aircraft construction at different stages of its evolution. The de Havilland Company is noted particularly for its contributions to this type of airplane structure. Included in the illustrations is a table showing the strength values of various woods, based on 15 per cent moisture content, for use in aircraft design. *The Aeroplane*, October 22, 1943, pages 470–473, 7 illus.

The Mustang's Bomb Rack. Ken West. A description is given of the design and construction of the plastic bomb rack manufactured for the Mustang. This rack is an external detachable device that can be put on or taken off the plane at will. Problems connected with the development of the rack are outlined. *Modern Plastics*, November, 1943, pages 75–77, 170, 7 illus.

Scarfed Joints. The design and practice of scarf jointing are reviewed. Four major factors are listed for consideration: (1) standard scarf designs, (2) cutting the bevels, (3) bonding the lapped ends, and (4) arrangement of multiple sheets. Subject material is arranged under the following headings: scarf-jointing practice, types of joints, cutting the bevel, bonding scarf joints, and building up large panels. *Aircraft Production*, November, 1943, pages 552–554, 6 illus.

New Application of Heatronic Molding. A brief description is given of a recent example of the successful use of high-frequency heating of phenolic materials in the brush holder in the control mechanism of a controllable-pitch propeller. The part is of a confidential nature and a detailed description is not included, but the approximate dimensions are specified and the difficulties overcome in molding it are given. Information is given on the machinery and materials used, together with the temperatures at which tests were applied. *Modern Plastics*, November, 1943, pages 106, 107, 5 illus.

Injection Molding of Nylon. R. B. Akin and J. E. Teagarden. A technical discussion of the injection molding of nylon deals particularly with the grade of the material known as FM-1. The information is offered to assist in the determination of the suitability of nylon for current military uses and for general use as a plastic after the war. The article is primarily devoted to a description of the properties of the material and its applications in general industrial production, although one of the products mentioned is a small spool about which are wound coils for actuating aircraft instruments. It is stated that nylon is used in this application because it resists operating temperatures that distort other thermoplastics. The wall thickness is only 0.012 in., far less than would be required with thermosetting molding powders to provide the toughness needed during assembly operations. The opposite sides of the smaller spools can be forced together until they meet; when released, they almost instantly resume their original shape.

Information is given on the properties of nylon FM-1 and the molding technique employed. This is accompanied by tables and charts. *Modern Plastics*, November, 1943, pages 115–120, 166, 19 illus.

Postwar Aviation

The Feeder Airline's Place in Postwar America. James G. Ray. The Vice-President of a company already operating a feeder air line discusses some of the problems pertinent to this type of air transportation and analyzes some of the future services it can render. He takes up the problem of maintaining schedules for feeder air lines and shows how the pickup type of operation is a major factor in the solution of this problem. Establishing the premise that the most promising approach to the problem of maintaining good cruising speeds on feeder lines lies in attempting to get planes through scheduled stops with a maximum loss in time of 5 min., he suggests certain features that will have to be incorporated in the design of both air-

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planes and airports. Among these is the building of flight strips, laid out parallel to the course of the feeder route, and long enough to permit the aircraft to land from either direction without the necessity of circling, except in the case of strong following winds.

The writer also notes that the establishment of feeder air-line services will furnish additional jobs for aviation workers and will provide the aircraft factories with work during the reconversion period. *Aviation*, November, 1943, pages 116, 117, 300, 303, 304, 307, 308, 3 illus.

Post-War Policy. As formulated by the Economic Development Committee of the Aeronautical Chamber of Commerce at their meeting in Colorado Springs in September, 1943, recommendations for dealing with the aviation industry's principal postwar problems are reported. There are 13 recommendations dealing with contract termination, five with contract renegotiation, four with the use and disposition of surplus government-owned aircraft, one with the use and disposition of defense plants and equipment, and six with export. *Western Flying*, November, 1943, pages 64, 98.

New Horizons for the Airlines. W. A. Patterson. Some observations on future developments in air transportation are given by the President of United Air Lines. In his comments he predicts that: (1) air transportation will supplement rather than supplant other forms of transportation, and will promote business for all types of carriers; (2) in the immediate postwar period airliners of the Douglas DC-4 and Lockheed Constellation type will be used and not the mammoth types often discussed; (3) the air lines of the United States will have to work together under private enterprise to cope with foreign-owned monopolies for international business; (4) charges for carrying passengers and cargo will be lowered; (5) new commodities will be added to the list that can be transported by air; (6) new passenger and cargo feeder services will be developed. *Midwest Aviation and Yachting*, November, 1943, pages 8, 9, 25, 4 illus.

Needed—300,000 Post-War Pilots. Russ Brinkley. The job outlook for postwar pilots is discussed. It is stated that today there are numerous indications that despite the thousands of men trained in aviation, there is destined to be an actual shortage of pilots to meet the demand that will develop after the war's end. *Flying Aces*, January, 1943, pages 12, 13, 45, 57, 58, 5 illus.

Landing Places Key to Private Flying. Charles Evans. Various aspects are discussed in connection with a suggestion that 25,000 landing places will be needed for private fliers after the war. It is noted that not more than 4,000 airports have been planned, but the writer indicates that if any considerable number of the nation's 27,000,000 automobile owners turn to the airplane for personal travel the suggested number of landing places will be fully needed and used. The repetition of history is recalled in connection with the fact that the coming of the automobile necessitated the building of thousands of miles of roads on which to operate them. In a similar matter, it is predicted that the airplane will "build its own" landing places. Two of the factors pointing toward a need for a great increase in the number of landing places are: (1) the possibility of a postwar public works program of which airport and landing strip projects would be a logical part; and (2) production of safe and simple planes for the family use. The activities of various aircraft companies and the promotion of civilian flying are reviewed, especially the promotion work of Cessna and that company's suggested plan for simplified navigation aids.

The costs involved in such a program are considered to be relatively small in comparison with the advantages anticipated. Other proposals also are mentioned and comments are made about the prospects for the quantity production of aircraft suitable for the average civilian. *Automotive News*, November 29, 1943, pages 8, 31, 1 illus.

From Uniforms to What? Henry J. Taylor. The first of twelve articles by political, social, and industrial economists on the postwar problems confronting American industry. In this article the writer is concerned with the problem of re-employing the men who are now in the armed forces. His outlook is an optimistic one based mainly upon two factors: the attitude of industry, as demonstrated by the fact that throughout the country all types of business are preparing programs now for the conversion period; and the psychology of the men themselves, conditioned daily by the methods of this war in the spirit of enterprise. With industry's current preparation for plant expansion, new products, new designs, wider marketing, and better training, he claims that business can hire more persons now in peacetime than in any previous peacetime period. As evidence of this point, he outlines the steps along which companies are making their plans.

The writer also makes a suggestion with regard to vocational training for postwar jobs. He advises that emphasis in vocational training should be put on re-employment in selling rather than on production. *Aero Digest*, November, 1943, pages 113–115, 280, 4 illus.

Production

Production and Personnel Innovations at the Woodworth Plant. This article deals with some of the machine tools devised and built by the N. A. Woodworth Company of Michigan to meet its manufacturing problems when, at the outbreak of the war, it expanded rapidly from a small tool shop to a large-scale producer of engine parts for the Wright Aeronautical Corporation. In addition, several of the company's procedures for recruiting, testing, classifying, and training personnel are noted. The following are among the tools described: a relatively small, bench-mounted radius grinder consisting of a motor-driven grinding wheel and an oscillating fixture; small surface grinders—featured by a plate, integral with the grinder, to guide the fixture holding the work; a battery of three Cincinnati centerless grinders, linked together by a work chute to perform successive grinding operations on the valve tappet; a tri-spindle machine for simultaneously drilling three oil holes into an adjusting screw; devices for testing adjusting screws; and a thread gauge that checks pitch and lead. *Aero Digest*, November, 1943, pages 168, 171, 5 illus.

An Introduction to High-Speed Milling. Paul Dubosclard. The high-speed machining of wing spars and wing-spar caps is discussed. The writer carried out the work of designing and building a machine suitable for milling aircraft spars. The greater part of the article is devoted to an account of his experiences based on the performance of about 80 of these machines in operation at the present time, which are stated to be doing the work of about 10,000 conventional mills. Sections of the article cover a description of the spar-milling machine, operating results, the vertical spindle versus the horizontal spindle, and the high-speed milling of ferrous alloys. *Mechanical Engineering*, December, 1943, pages 865–870, 14 illus.

Salt Bath Treatment of Aircraft Parts. Stewart M. DePoy. Applications of the neutral salt bath to aircraft parts are discussed. It is noted that when the neutral salt bath was developed to the point where it was economical for industrial use it marked the end of the search for a suitable means of heat-treatment for aircraft parts. One of the biggest advantages of the salt bath is that material can be left in it for long periods of time without danger of surface contamination. It is stated that the bath is an excellent medium for copper brazing and has proved a blessing to the nonferrous industry. Artificial aging of the high-tensile aluminum alloys is speeded up considerably by heat-treatment in the neutral baths. *Automotive and Aviation Industries*, November 1, 1943, pages 38–40, 156, 4 illus.

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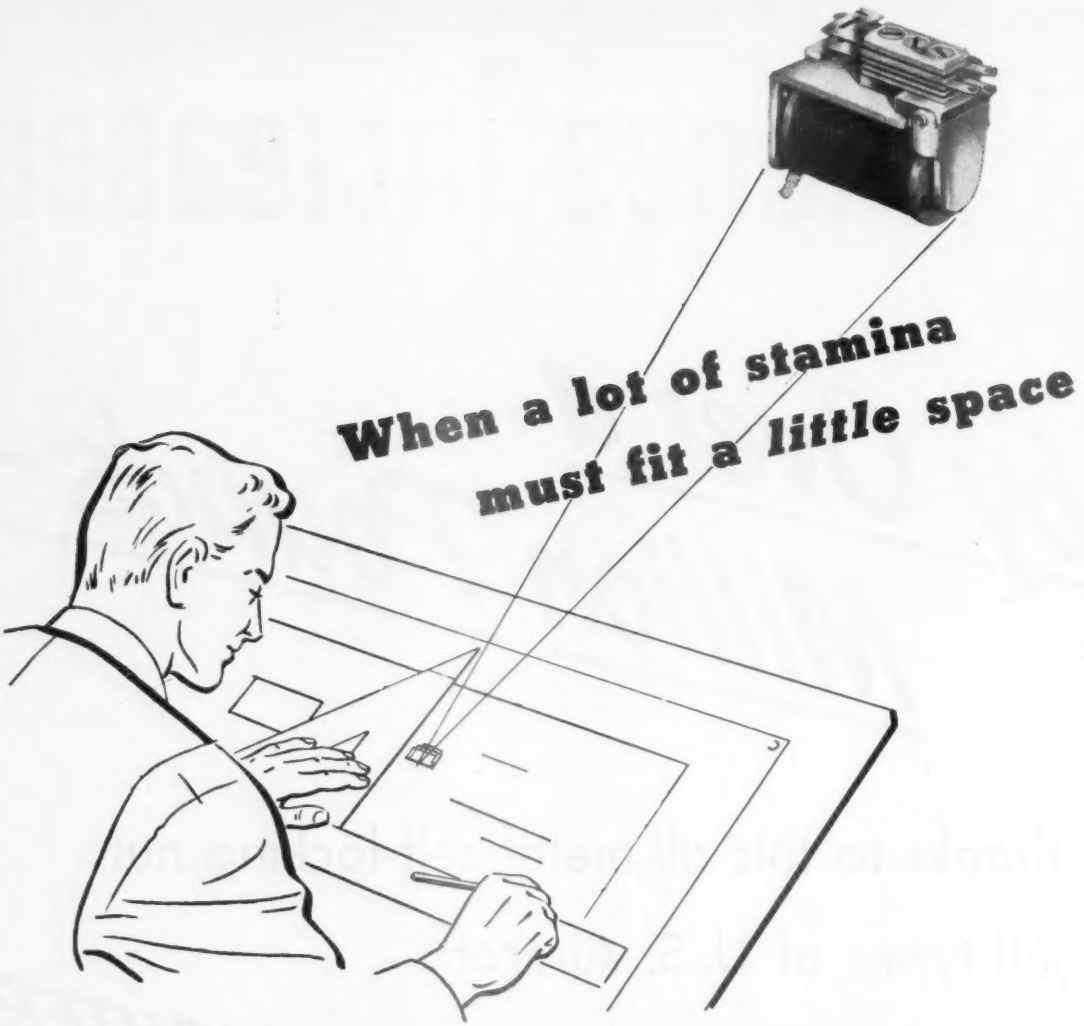

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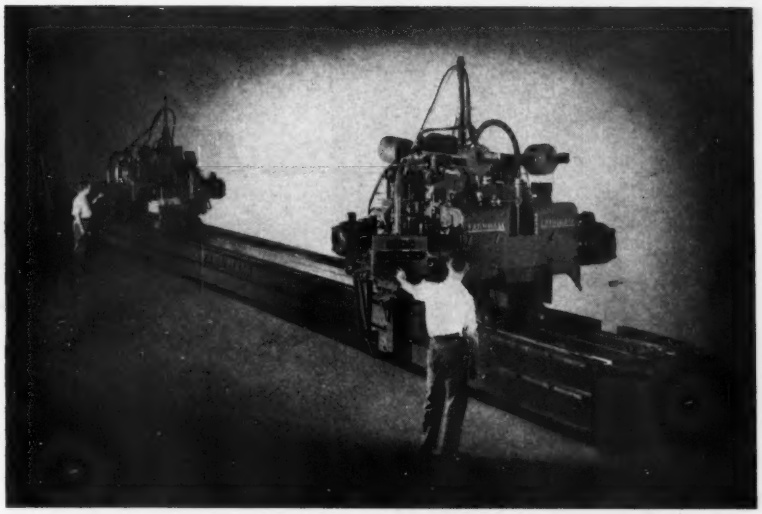
PARTS AND ASSEMBLIES FOR EVERY ELECTRICAL CONTROL NEED

Aircraft Production Analysis Key to Assembly Line Efficiency. Part I. Loren F. Dorman. The first part of a study on the basic principles of progressive line-assembly methods deals with the analysis of design and manufacture which reduces the production of an aircraft to simple planning operations. As outlined, production analysis consists of four progressive phases, each developed and coordinated with the others. First, there is the breakdown that provides for a complete production analysis of the airplane during the design stage in order to establish suitable components for construction relative to those items that affect fabrication and assembly. Items for consideration are handling size, jigging, sequence of assembly, interchangeability, subassembly, etc. The next phase provides for the production planning and line-assembly planning of those items established in the first phase. Phase three consists of production control—a procedure whereby major units, minor units, component parts, and installations are ordered, accounted for, handled, stored, and issued in accordance with assembly-system requirements. The fourth phase is the use of production illustrations for the conveyance of detailed production information based on the use of perspective drawings.

Applicable to both final and feeder-line assembly systems, procedures for the development of final line assembly are detailed. Illustrations include a chart showing the procedure of line-assembly development, a job-unit operation sheet, a work-loading chart, a zone chart, and five production-breakdown drawings—one of the entire aircraft, one of minor wing units, another of the fuselage assembly, a fourth of a typical installation, and a fifth of a bench assembly. *Aviation*, November, 1943, pages 148–152, 332, 335, 8 illus.

Advantages of Metal-Back Chafing Strips. Bernard Gross. The application of metal-back strips to prevent chafing between metal aircraft parts is described and the superiorities of this system over other methods of chafing prevention are demonstrated. The metal-back chafing strip is made up of a strip of synthetic rubber which has cutouts to permit spot welding or riveting and which is vulcanized to a piece of metal that is in turn spot welded or riveted to a structure. It is claimed that this type of strip not only eliminates routing of parts to some station where cementing is done but also eliminates routing of large parts to still another department for the vulcanizing of the sheet rubber-like stock to the part itself.

The vulcanized strip is also stated to have greater adhesive and structural strength than the cold-cemented strip. A comparison of man-power requirements for assembly application of riveting and cold-cemented strips versus chafing strips credits the latter with a laborsaving of 80 per cent. Weight studies between the two methods show the difference to be negligible so that an engineering change is not necessary when replacing the older type with the metal-type chafing strip. *Aero Digest*, November, 1943, pages 176, 178, 180, 10 illus.



Stated to be the largest spar miller ever built, the Farnham two-carriage unit shown above has an overall length of 91 ft. with a table length of 80 ft. (*See* page 160.)

Design Behind the Luftwaffe. Albert A. Brandt. An outline is given of how German designers and factories concentrated their energies on the production of military aircraft under a "smoke screen" of civil aviation following the Treaty of Versailles. Information is given on the men responsible for the development of the Luftwaffe's equipment. *Aircraft Age*, December, 1943, pages 6–9, 48–50, 26 illus.

Electrochemical Removal of Broken Tools. J. L. Bleiweis and A. J. Fusco. A description is given of a quick, automatic, electrolytic method for the removal of broken tools, such as drills, taps, and reamers, which have so broken that part of the tool remains lodged in the work. The method is reported to be of special value for removing broken tools from aluminum and magnesium parts. For other materials (and for other than steel tools, also) nonelectrolytic chemical methods have been developed. These methods are also described.

The writers outline the principle involved in the electrolytic process and describe the laboratory apparatus and the commercial setup. *Metals and Alloys*, November, 1943, pages 1075–1080, 10 illus.

Aircraft Parts and Fixtures Manufacture at Herron-Zimmers Plant. An article on some of the manufacturing methods innovated by the Herron-Zimmers Moulding Company when it converted from the manufacture of metal trim for peacetime products to the custom building of aircraft jigs and fixtures and the production of aircraft parts. Among the features noted are techniques in connection with using cast-steel base plates for building air-frame fixtures, the employment of a fixture for eliminating excessive welding by holding tubes at any required angle on a vertical mill, and procedures developed for ball-turret ring production. *Aero Digest*, November, 1943, pages 224, 226, 228, 7 illus.

The Horsa Glider. Wilfred E. Goff. The second half of a two-part article on the production of the Airspeed Horsa. This installment is devoted to details on the fabrication of the outer wing panels and the various components of the tail unit, as carried out by the coach-building and wood departments, respectively, of two large-scale car manufacturers. One of the major points of interest centers around the pneumatic clamping method employed for applying pressure to bond the skin to the structure.

Descriptions of procedures, equipment, and materials are particularized under the following headings: spar booms, scarfing spar laminations, spar assembly, spar webs, spar drilling, nose structure, main assembly fixture, trailing structure, and sequence of assembly. Other headings relate to the tail unit, the second stage of the tail-plane assembly, pneumatic clamping, the fin, the rear fin post assembly, and the rudder and elevator. *Aircraft Production*, November, 1943, pages 518–529, 40 illus.

Republic Aircraft Products Specializes in Precision Machined Engine Parts. Joseph Geschelin. A study

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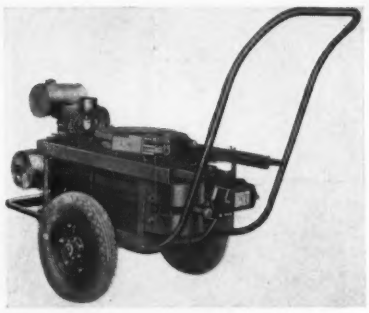
concerned primarily with the activities in the headquarters plant of Republic Aircraft Products, a division of The Aviation Corporation. Information is given on the modern precision machinery used for the manufacture of engine parts. It is explained that this plant is departmentalized to handle many parts on a job-lot basis, routing such parts through the centralized screw machine and lathe department and through the general grinding department. Other parts, such as the spring lock and locking plates and valve-tappet guides, are processed through a completely self-contained department. *Automotive and Aviation Industries*, November 15, 1943, pages 26–29, 76, 11 illus.

Control for Conservation of Aircraft Materials. The program of the Army Air Forces and the Navy Bureau of Aeronautics to conserve materials, man power, and production facilities through the promotion of more efficient and more economical methods in the manufacture of aircraft and accessories is outlined. The functions of each of the following groups in connection with the program are summarized: the Resources Division of the Army Air Forces and the Matériel Group of the Navy Bureau of Aeronautics; the respective field organizations of the A.A.F. and the N.B.A.; and the Operating Committee on Aircraft Materials Conservation. A chart shows the organization setup by which coordinated action of the various units of the A.A.F. and N.B.A. will operate to replace manufacturing processes resulting in excessive waste of materials, man power, and facilities. Some of the more economical practices to be encouraged are named, as well as some of the problems that will be dealt with. *Aero Digest*, November, 1943, pages 249, 463, 1 illus.

Success of Outworking. Organized in the London area, examples of successful outworking units are cited. The article also indicates types of work most suitable for assignment outside the factory. In this list are cable harness, electric terminals, certain types of lamps, wireless parts, armature coils, condensers, and the assembly of small units. *Aircraft Production*, November, 1943, page 540, 2 illus.; "Outworking," *Flight*, October 14, 1943, page 424, 2 illus.

Replacing Extrusions with Rolled Formed Sections. John Cramer. An outline is given of a study carried out by Boeing for the purpose of developing a group of rolled-formed sections from aluminum-alloy strip which could be used to replace the simpler extrusion now in use. Typical examples of extrusion conversions to rolled sections are described and illustrated. *Western Flying*, November, 1943, pages 48, 50, 104, 6 illus.

Gravity Diecasting. Part III. Concluding article of a series on the production of light-alloy gravity die castings at a Rolls-Royce shadow factory. Describing the final stages of the process, this article covers solution treatment, aging, and material inspection. It also discusses the type of labor employed at the foundry and reviews the characteristics of five important alloys used for the die castings—RR.50, BSS LII, BSS LII+ magnesium, BSS L33, and N.A.226. *Aircraft Production*, November, 1943, pages 512–515, 6 illus.



The Pacific Airmotive portable power unit. (*See* page 167.)

Associate Producers Plan Speeds CG-4A Gliders. Otto W. Timm. An account of how eleven California manufacturers of varied experience pool their facilities to build CG-4A troop transport gliders. The article lists the associates, briefly outlines the backgrounds that prompted their selection, and notes the more important features of their manufacturing procedures and equipment. It is related that each of ten members of the group fabricates one or more components that are sent to a centrally located final-assembly line operated by the eleventh member—the Timm Aircraft Corporation. This system is claimed to entail neither excessive transport requirements nor new plant construction. Materials, general supervision of fabrication expediters, and, in some instances, the time-keeping and bookeeping are supplied by the Timm organization. Other than that, each company does its job through means developed by its own staff. *Aviation*, November, 1943, pages 121–131, 29 illus.; "Building the Waco CG-4A Glider," *Aero Digest*, November, 1943, pages 208, 210, 215, 11 illus.

The Development of Aircraft Detail Fittings. Part III. W. Cookson. A continuation of a discussion on the production of detail fittings for airplanes. The development of a rudder wheel fairing that can be satisfactorily fabricated by hand methods is described. *Sheet Metal Industries*, November, 1943, pages 1941–1944, 4 illus.

This Plant-Within-Plant Assures Peak Production. The functions of the miscellaneous parts department of Consolidated Vultee's San Diego plants are surveyed. Dealing only with unusual problems and emergency work, the activities of this department duplicate on a small scale almost all of the production capacities of the San Diego division in the fabrication of parts and small subassemblies. In addition, it operates as a salvage department; a repair shop for tools, machinery, and parts; a job machine shop for building experimental tools and jigs; and a spare-parts manufacturing plant. Notes are included on the type of personnel comprising the miscellaneous parts department, the materials with which it works, and examples of some of the diversified jobs it performs. *Aviation*, November, 1943, pages 161–163, 299, 300, 7 illus.

Naval Aircraft Factory. Lt. George N. Shumway. The activities of the Naval Aircraft Factory at the Philadelphia Navy Yard are outlined. It is related how, in addition to producing Navy planes, the N.A.F. fabricates parachutes and tow targets, tests aircraft manufactured by other plants, and conducts research programs on everything from pressure chambers to aircraft paint. *Flying*, December, 1943, pages 44, 45, 188, 4 illus.

Diamond Lock Riveting. G. G. Williams. A brief study of the diamond lock method of riveting. Its principles are explained, its applications examined, and its advantages related. A development of tack or stitch riveting, diamond lock riveting is designed to increase jig output from 33⅓ to 50 per cent in the production of stressed-skin types of aircraft. The article also shows how, by the manipulation of labor, savings in floor space can be effected in addition to the accelerated production. *Aircraft Production*, November, 1943, pages 544–546, 6 illus.

Boosting B-25 Output. Features of the North American Aviation system of producing Mitchell bombers are noted. Among these is a turntable elevator on the main assembly line, installed at the California plant. By means of this device combined sections of the bomber are raised and lowered to desired heights for working convenience and are rotated into various positions for further assembly. The article follows the subassembly through progressive elevation and turntable operations to its trip along the power-driven assembly line. It is noted that the P-51 Mustang fighter is also manufactured according to the component-breakdown plan. Production methods applied to the P-51 are reviewed. *Western Flying*, November, 1943, pages 40, 41, 100, 5 illus.

Models Help in Production Planning. Harvey G. Groehn. The utility of models for production planning is explained. First the article is concerned with the planning function performed by miniature scale models and fixtures embodying desirable breakdowns of assemblies and subassemblies. These help to de-

termine how the fullest and best use can be made of available factory space. Second, it is concerned with the full-scale master mahogany models that are built to represent each section of the miniature breakdown. These have three major purposes, each of which is expounded: (1) to check the original master engineering layout and templates; (2) to provide three-dimensional detailed information needed to plan operations on individual parts and to determine setups and assembly sequences; (3) to furnish a means of transferring the correct detailed shapes, contours, trim and flange lines, holes, offsets, embossings, etc., to every tool involved in the fabrication of each individual part in the assembly. Materials for making the models are described. *Aero Digest*, November, 1943, pages 260, 262, 264, 286, 8 illus.

Propellers

How AA's Propeller Shop "Keeps 'Em Turning." Edward E. Thorp. American Airlines' methods of maintaining and servicing propellers are related. In addition to describing the physical and mechanical procedures of routing the blades and other parts, the article includes data on the records and forms that constitute the basis of the system's "paper work." Among the illustrations is a sketch of the propeller shop's floor plan and a chart showing how the components of the propeller are routed through the shop. *Aviation*, November, 1943, pages 205, 207, 208, 290, 293, 8 illus.

Aircraft Propeller Blade. Elek K. Benedek. In the first part of a continued article describing the production of a welded steel aircraft propeller, various problems are discussed in some detail. The purpose is to provide a more effective and simplified welded structure and to show that welding, especially arc welding, is the most suitable method. Problems considered are the transmission of the high power now used for aircraft, thrust, flutter, centrifugal force, and other stresses. Comparisons are made between steel and other materials used in propeller construction, and designs are suggested for the elimination of difficulties found in materials formerly and presently employed. The writer believes that the proposed method of production will not only be better and stronger but also more suited to production and control. *The Draftsman*, November, 1943, pages 23–25, 13 illus.

Radio

Radio and Post-War Private Flying. Sydney Nesbitt. Some observations are made on probable radio developments for small planes after the war. Citing the advantages of ultra-high frequency, the writer explains why he believes that ultimately there will be

The Hydromatic propeller of a Vought Corsair gets a final balance test following assembly at Hamilton Standard Propellers.

a complete changeover to ultra-high-frequency radio systems. However, he predicts an indeterminate period immediately after the war when private fliers will have to buy and use low-frequency radios, with the expectation that the equipment will soon become obsolete. In describing considerations for the postwar aircraft radio manufacturer to keep in mind, he designates price as the most important, followed by the fact that the apparatus must be simple in operation, light in weight, and compact. A mythical installation is depicted which contains all the requirements thought necessary by the writer for the "ideal" radio with which to equip the postwar private plane. *Western Flying*, November, 1943, pages 42, 43, 102, 114, 3 illus.

Radio in the Civil Air Patrol. Karl H. Stello. This article deals with the radio work being done by the Civil Air Patrol and some of the problems involved. Describing the inadequacies and variations of equipment as well as the difficulties of repair, it lauds the efficient radio job that the "ham radio spirit" is doing in spite of handicaps. Some predictions with regard to postwar development of radio equipment are included. *Southern Flight*, November, 1943, pages 38, 46, 48, 56, 1 illus.

Research

Aircraft Development—Confidential. Franklin H. Stevenson. An article on the general importance of scientific research in aircraft development, with attention called particularly to the work being done by the National Advisory Committee for Aeronautics. The fact is brought out that, in spite of the Committee's concentration on war problems, nearly all of their findings will be applicable also to the improvement of the efficiency and safety of civil and commercial aircraft after the war. Some data are included on the laboratories maintained by the Committee. *Skyways*, December, 1943, pages 53, 54, 84, 98, 6 illus.

Rotating Wing Aircraft

PV-2 Helicopter Makes First Public Flight. Design, specification, and performance data are presented on the PV-2 Helicopter, designed and built by the P-V Engineering Forum, Inc., of Philadelphia, and recently demonstrated for the first time in public at Washington National Airport. As reported, the top speed of this single-place helicopter is 90–100 m.p.h., its cruising speed is 65 m.p.h with the 25-ft. diameter rotor blades turning at 350 r.p.m., and its range is 2 hours. Powered by a 90-hp., four-cylinder Franklin air-cooled engine, the PV-2 is said to be free of vibration and flutter characteristics in changing from vertical to horizontal speed or in picking up speed horizontally. *Aviation*, November, 1943, page 229, 1 illus.; "The PV-2 Helicopter," *Aero Digest*, November, 1943, page 188, 1 illus.

Let's be Calm About the Helicopter. Lou Leavitt. Pointing to the case of the autogyro as an example, the writer claims that too much of the wrong kind of publicity is apt to retard the progress of the helicopter. It is his opinion that the type of promotion accorded the helicopter today—publicizing it for pleasure flying and as the "family car' of the future—diverts the course of its development from following the needs of the specific operations to which it is most naturally adapted. He names the following as among the more important of these: (1) The helicopter is needed by the Coast Guard for shore patrol, for rescues at sea, for the transfer of sick or wounded ashore. (2) It is needed by the Department of Agriculture for insect control, for the spraying of crops and orchards, for the spotting of infestations from the air. (3) It is needed by the Forestry Department for fire spotting, for the placing of personnel and equipment where they will do the most good in fighting large fires, and for the direction of fire fighting from the air. (4) It is needed by the military services for transfer of personnel behind the lines, for artillery fire control, for courier service. The helicopter's applications for intercity mail lines and for the requirements of farmers and large-scale ranchers are also indicated.

With regard to the condition of present helicopter development, the writer emphasizes the fact that the publicity is far ahead of the development. The helicopter is in its first stages of evolution, he reports, giving as the reason for this the fact that the diversion of power from lift to effect control is no more the ultimate solution for helicopter efficiency than is the mechanical complexity of twin rotors. *Aviation*, November, 1943, pages 114, 115, 335, 1 illus.

WRIGHT POWERS THE TONNAGE OF THE AIR

An aircraft engine supercharger is not a mysterious device; it is simply an air pump. By compressing more air into a cylinder, more fuel may be burned during each power stroke—which in turn means greater output. At sea level or altitude, whether turbo or gear driven, a supercharger's sole purpose is to increase engine horsepower.

Although it takes power to pump air with a supercharger, the result is a dividend of free horsepower far exceeding the investment. Flight at high altitude is impossible unless the rarefied air is first compressed, while in a Cyclone 9 at take-off, 100 HP spent to drive the supercharger rewards the engine with 500 additional horsepower at the crankshaft.

★ ★ ★

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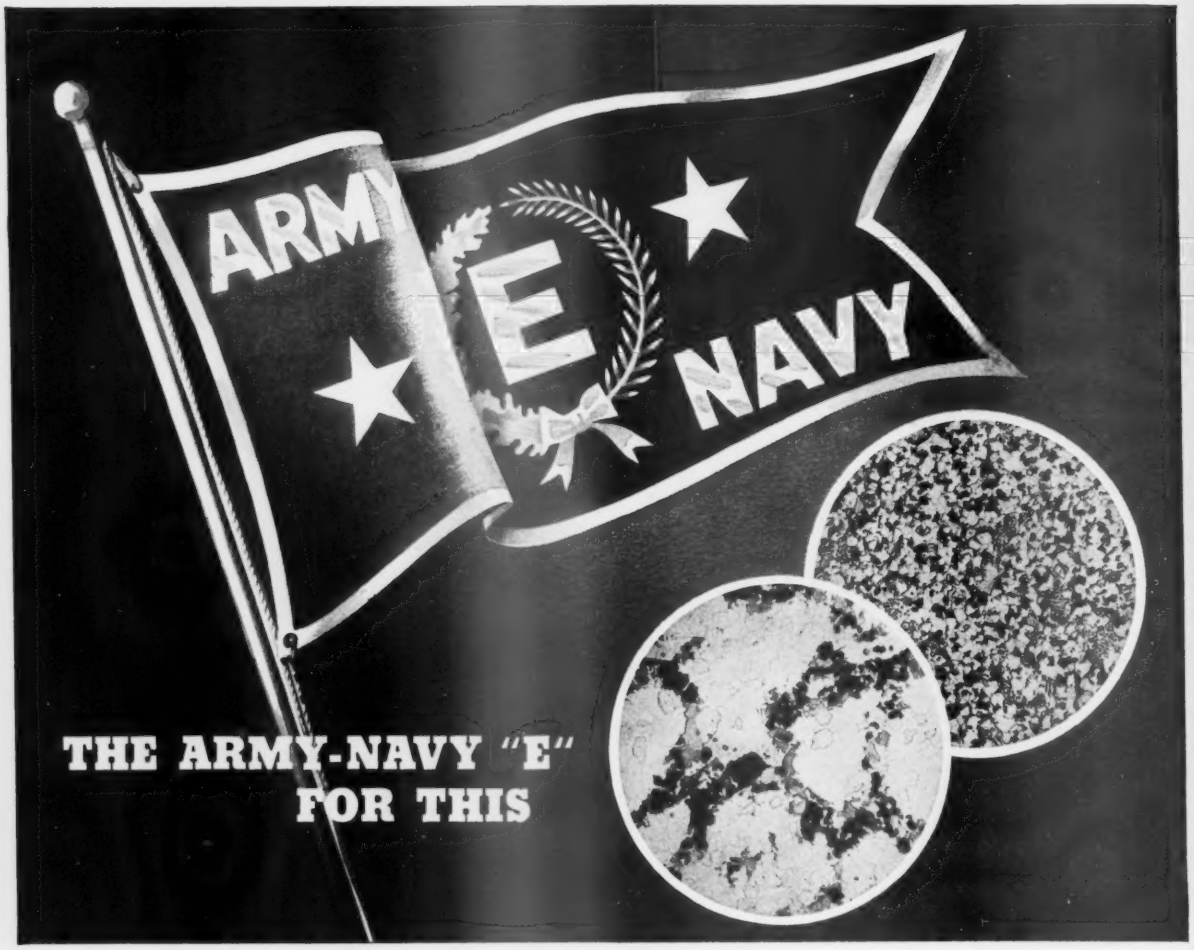
A supercharger supplies combustion air at greater density, permitting increased engine power.

Cyclones and Whirlwinds · Light · Compact · Powerful **WRIGHT** *Aircraft Engines*



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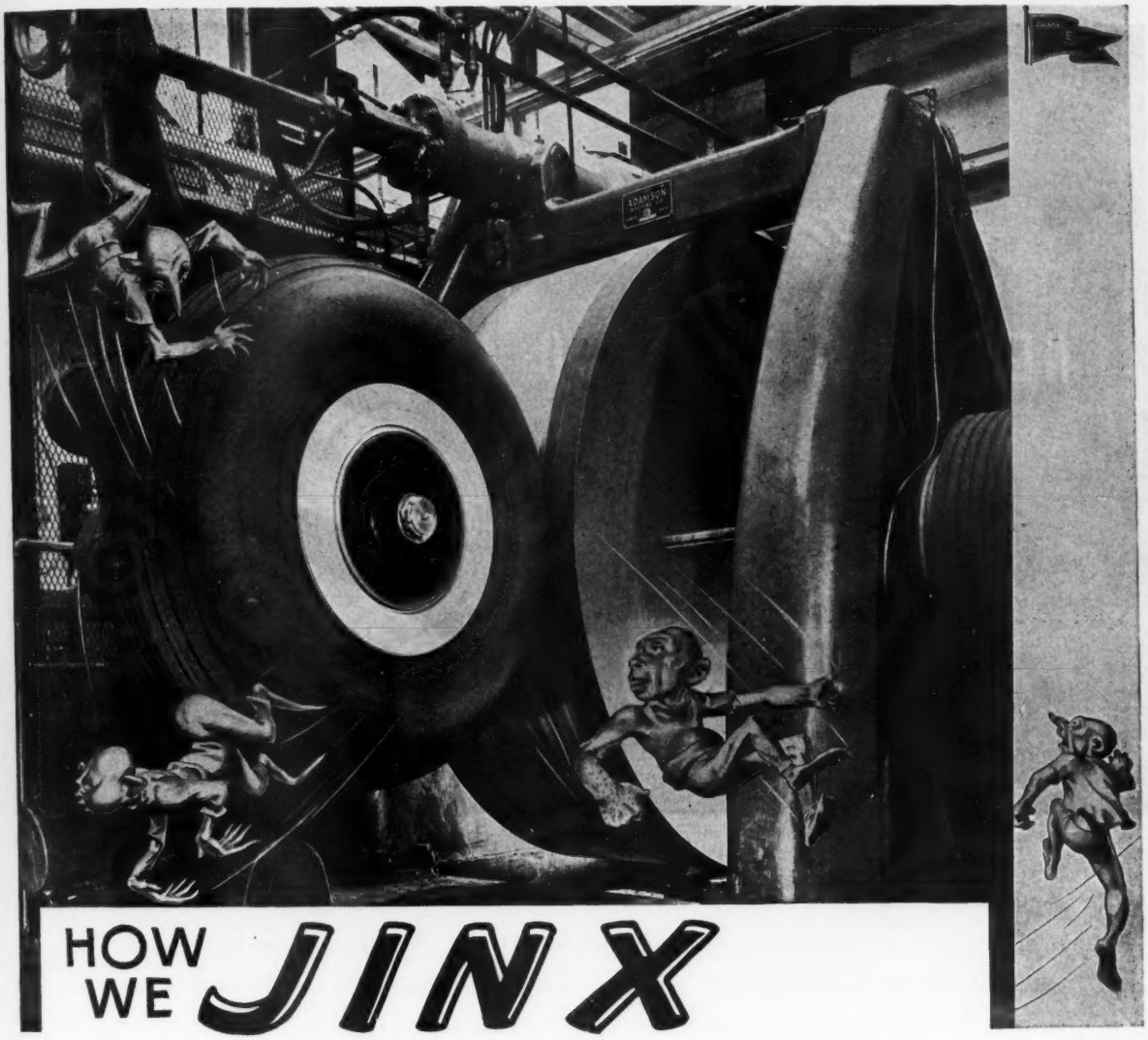

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With electric motors for a bomber's accessory equipment ranging into dozens of horsepower, considerable electricity has to be distributed to many points throughout the plane. Bus systems have become regular networks—"like all downtown", says one engineer—so that their weight introduces a serious problem.

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Stress Analysis

Mechanics of Sheet-Metal Bending. William Schroeder. The basic mechanical phenomena occurring during the bending of sheet materials are discussed. Analytic methods are given whereby all aspects of behavior during and after bending, such as forming pressure and springback, can be accurately predicted on the basis of the stress-strain diagram of the material. An experimental and analytical study of the strain distribution in the bend is also included. *Transactions of the A.S.M.E.*, November, 1943, pages 817–827, 16 illus.

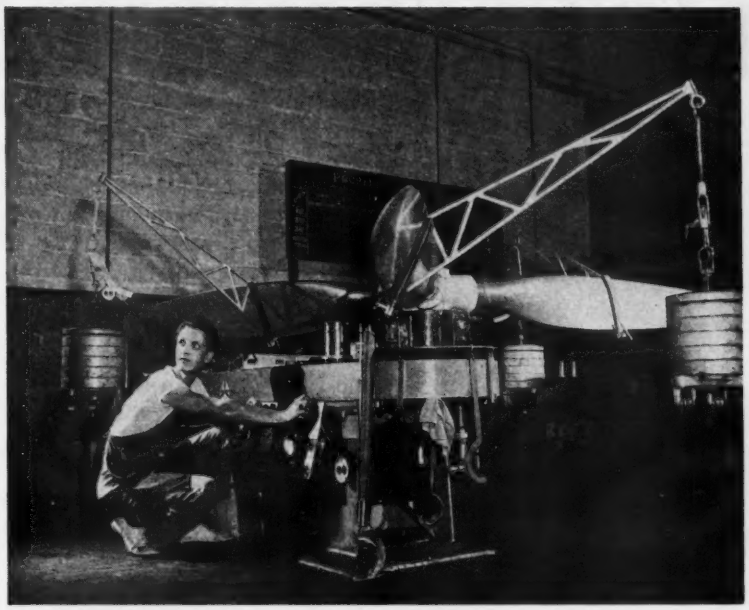
Analysis of Members with Variable Moments of Inertia. Yves Nubar. Tracing their derivatory steps, this article presents essential data and characteristics for analyzing structural members with varying moments of inertia, including the general expression for the slope deflection equations, fixed-end moments, stiffness and carry-over factors, three moment equations, etc. Analysis of a twin-boom system for a large airplane is outlined for illustration. *Aviation*, November, 1943, pages 153, 154, 328, 331, 332, 8 illus.

Superchargers

Proposed Expressions for Roots' Supercharger Design and Efficiencies. F. A. Hiersch. This paper defines proposed positive-displacement blower efficiencies in four equations in terms of slippage air, which is taken as a means of rating the design of the blower. Another equation is given which may be used to obtain what is defined as the "slip" polytropic-compression exponent. The first example shows actual details of computation of optimum rotor-bore diameter and axial length for a given delivery volume, speed, impeller clearance, and head, based on the methods given by K. Schopper. The volumetric efficiency for the given blower design is then compared with that of the optimum-design blower.

These results are then applied in the first two of the four equations mentioned. In the second example volumetric efficiency is plotted against the ratio of axial length to bore diameter with conditions fixed as in the first example. These results may also be applied to the first two equations. *Transactions of the A.S.M.E.*, November, 1943, pages 853–855, 1 illus.

Turbosuperchargers. S. A. Moss. This article is based on a talk before the Aviation Writers Association in New York City. It presents a brief, simplified explanation of turbosuperchargers, together with some observations on their mass production and maintenance on world-wide combat fronts. *Air Pilot and Technician*, October, 1943, page 29, 1 illus.



A General Motors Aeroprop undergoing test. Note the 275-lb. weight suspended from each propeller.

Testing

A Test for Measuring Drawability at Deep-Drawing Steels. Francis W. Boulger and F. B. Dahle. After discussing the reasons for the failure of present standard tests to evaluate the suitability of sheet metals for deep-drawing operation, the writers propose an experimental testing method. This method embodies a cup-drawing procedure that integrates the properties in a steel needed to satisfy the drastic drawing operations met in service.

It is stated that the data indicate that the cup-drawing test method is accurate and reproducible in showing differences between materials of ostensibly similar quality. A comparison of a few test results with service performance figures shows a good correlation between press breakage and cup-drawing ratings. The behavior in the experimental test equipment rated materials in an order different from tension, hardness, and cupping tests. This does not disprove the suitability of the experimental method because the standard methods are known to be unsatisfactory. The information further indicates that increases in carbon and sulphur contents lower the cup-drawing ratings but that variations in manganese, copper, and phosphorus, for the ranges covered by the sample group, were without effect.

Temper rolling lowers the cup-drawing ratings and the effect is most pronounced in the neighborhood of 0.75 per cent reduction. *Sheet Metal Industries*, October, 1943, pages 1777–1780, 3 illus.; November, 1943, pages 1959–1966, 11 illus.

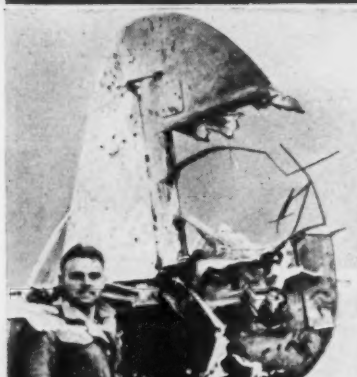
Testing Equipment

Regenerative Dynamometers. Details are given on the Heenan and Froude dynamometers for regenerating power developed on aircraft engine test beds. Of the a.c. regenerative type, this dynamometer is described as consisting essentially of a constant-speed alternator coupled to the engine by an eddy-current magnetic coupling, the slip being automatically controlled by electronic means. At low speed, the alternator rotor is held stationary by a friction brake, the coupling in these conditions working at 100 per cent slip and thus absorbing the full power output of the engine. This regenerative dynamometer is reported to be similar in broad principle to the test beds in use at the Buick aircraft-engine division but modified to suit British requirements. A major modification is the addition of torque-reaction weighing gear. Further differences are noted. *Aircraft Production*, November, 1943, page 511, 1 illus.

Propeller Governor Test Bench. The development of a test bench for testing the governors used to control electric and hydraulic controllable-pitch propellers is described. To provide an understanding of some of the problems tha had to be met, information is given on the basic operating functions of the various governors. *Air Tech*, October, 1943, pages 36, 37, 60, 3 illus.

Automatic Temperature-Recording Control System. M. E. Moore. An automatic temperature-recording system designed primarily for use in flight-test work, but also adaptable to test stands, is described. Devel-

BRING 'EM BACK ALIVE



The safety of our daring airmen, as well as the safety of our country depend upon the ability of American built planes to accomplish their missions and return. The most important factor in the amazing superiority of our war planes is their ability to stay in the air and "bring 'em back alive" despite extensive damage. Certainly the countless fastenings which hold these planes together share equal credit with the superb materials and precision American craftsmanship that produce their structural

members. Among these rivets, bolts, nuts, screws and special fastenings are millions of HOLTITE precision fastenings—and we are proud of the vital part they play in bringing back America's war birds alive.

The lives of our fighting men hang by a thread, and we are determined that any screw made at Continental will be the best that science and skill can devise.

Illustrations:
Top: Curtiss P-40 Tomahawk.
Center: Boeing Flying Fortress.
Bottom: Lockheed Hudson Bomber.

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oped by Douglas Aircraft, the system provides for the measurement of any number of points in groups of 24 each. The adaptation of this system to any automatic temperature-recording device is discussed and the requirements of such a device are stated. Design considerations are covered and the construction and operation of the system are described. *Transactions of the A.S.M.E.*, November, 1943, pages 809–815, 11 illus.

Tools and Equipment

Air-Pressure Control Unit. A description of equipment for converting high-pressure air so that it may be used also for low-pressure requirements. Fundamentally, the principle of operation consists of feeding the high-pressure supply into the flexible reservoir of the controller, which is spring-loaded to the required output pressure. When nearing the predetermined output pressure head, the reservoir expands to the point where the compression remains constant, providing also the means for automatically adjusting high-pressure feed to the outflow. Developed by a British company, the line of units includes single-stage, double-stage, triple-stage, and four-stage controllers, with the single-stage type suitable for output pressures of from 0.5 to 6 lbs. per sq.in. An example of the operating speed of a four-stage controller is the test loading of a 200-gal. airplane fuel tank to 5 lbs. pressure in 75 to 80 sec. The automatic controls that enable all tanks coupled together for test to reach the predetermined pressure at the same time are described. *Aircraft Production*, November, 1943, page 517, 1 illus.

Standardization of Cutting Tools. Carl J. Wiberg. A description of tests conducted over a period of 18 months in the shops of the Wright Aeronautical Corporation which resulted in the development of standardized single-point, high-speed cutting tools. The testing of various types of chip breakers is discussed. One section describes the standardization of sintered-carbide tools. Conclusions reached from the investigation are set forth. *Mechanical Engineering*, December, 1943, pages 871–880, 22 illus.

Swarf Removal. Particulars are given on the construction, operation, and advantages of a pneumatic unit for the removal of swarf. As developed by a British company for Avro Lancaster spar-milling machines, the equipment functions by means of a suction pipe connected to the cutter hooding. The swarf is delivered through the pipe into a large collector-box mounted on the traveling cutter head of the machine. Incorporated in the unit is provision for clearance of the swarf accumulation. It is stated that, in addition to permitting approximately 98 per cent of the swarf to be collected immediately from the cutters, the utilization of

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The men who literally "keep 'em flying," the ground crew mechanics of the Army, Navy, Marine and Coast Guard Air Forces, are daily performing prodigies of maintenance, service and repairs.

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Clifford's ⅔X is being put to good use by the United States Army Air Force . . . saving 130 pounds for one type of fighter—a weight-saving already translated into performance . . . and now being applied to another fighter with a ⅔X potential saving of 320 precious pounds.

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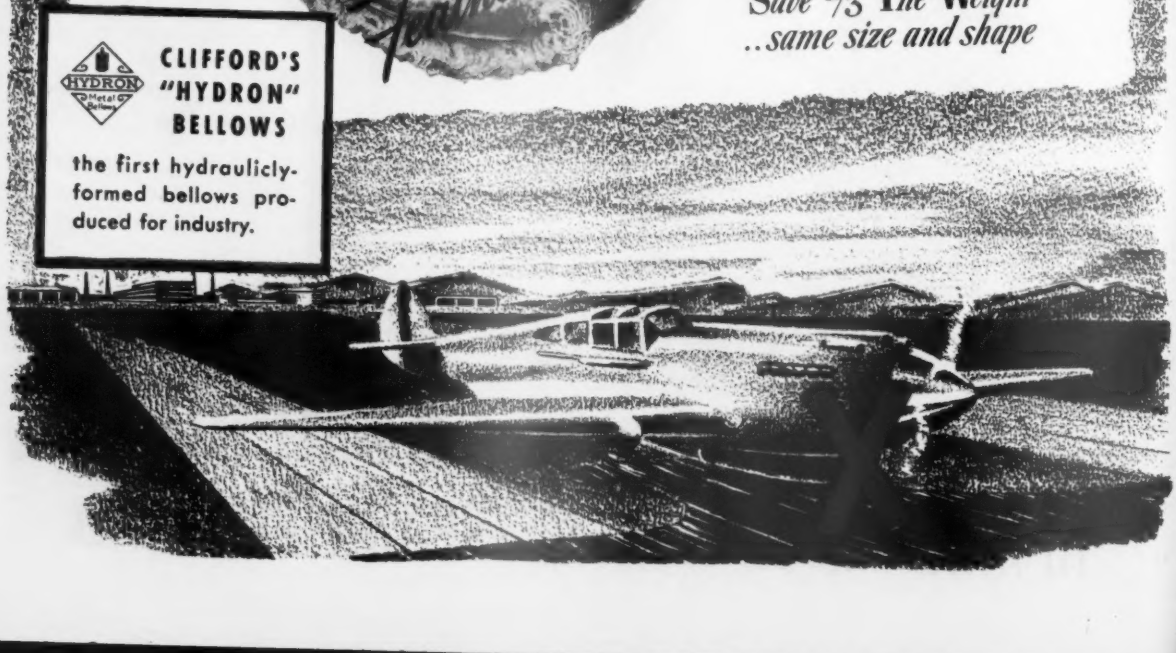

this pneumatic equipment saves the time formerly required for cleaning the machines. Contemplation of a portable unit for drilling, routing, and light milling machines is reported. *Aircraft Production*, November, 1943, pages 534, 535, 3 illus.

Router Screens. Some brief comments are given on screening equipment for fixed-head types of machines. While efficiently protecting the operator from flying swarf, this screen permits him a clear field of vision. It consists of a wooden framework, completed by curved panels of light-gauge, mild-steel sheet. If necessary, tubular lamps may be fitted inside the screen close to the router head. *Aircraft Production*, November, 1943, page 546, 2 illus.

Training

Finishing School. Lt. Col. Lawrance O. Brown. Fourth of a series of articles on primary, basic, advanced, and transitional flight training at schools of the Army Air Forces Western Flying Training Command. This concluding article outlines the curriculum of four-engined training, as carried out at the B-17 pilot school, Hobbs Army Air Field, N.M. Stress is laid upon the fact that in this last stage of instruction before assignment to operational units, Army Air Forces' bomber pilots are thoroughly trained in engineering and maintenance subjects as well as those of flight and ground school. *Western Flying*, November, 1943, pages 46, 47, 112, 6 illus.

Piloting Big Bombers is Big Business. Fourth in a series of articles on the flight-training schools of the Army Air Forces. This article is concerned with the four-engined transition schools where pilots are trained to fly B-24 Liberator bombers. As exemplified by the courses given at Tarrant Field, Tex., the nine weeks' curriculum is described in brief outline. *Aviation*, November, 1943, pages 223, 225, 3 illus.

Big-League Trainer. This article relates how B-34 Venturas are employed for the training of instructors at the Bomber Pilot Training Division of the Central Instructors' School at Randolph Field. Serving as aerial classrooms, the Lockheed-built bombers are used to work out new training procedures and to sharpen maneuvers mastered in smaller twin-engined trainers. *Flying*, December, 1943, pages 72, 73, 189, 2 illus.

Devices Help Train Paratroopers. Sgt. A. Christopher. A description of mechanical devices used as an aid to the training of paratroopers at Canada's parachute school at Shilo, Manitoba. Outstanding among these devices is a 250-ft. steel-ribbed jump tower that is illustrated. *U.S. Air Services*, November, 1943, page 27, 1 illus.

Aircraft "Plumbing." The Royal Air Force Technical Training Command school providing instruction on Handley Page Halifax aircraft is described. Attached to a manufacturing company, this school is intended primarily to give specialized training on Halifax aircraft to flight engineers, air crews, air-frame fitters, and electricians. Remedying action on all components for breakdowns and failures are dealt with exhaustively in addition to the normal maintenance operations and sequences. The article tells what the individual courses for flight engineers, air-frame fitters, and electricians cover and also describes some of the training equipment and mock-ups used at the school. *Flight*, October 7, 1943, pages 402, 403, 4 illus. "Servants of the Halifax," *The Aeroplane*, October 8, 1943, pages 412, 413, 5 illus.

Cloudbusters in Coveralls. An article reviewing the training activities and curricula of the Army Air Forces Western Technical Training Command. The subject is dealt with under sections discussing the task of turning out thousands of technically equipped men, the staff of the organization and the training of engine mechanics, gunners, and camera men. *The American Pilot*, November, 1943, pages 6–13, 35 illus.

Who Said "Draft Dodgers?" Earl D. Prudden. Official approval of standard uniforms for civilians who give primary flight training to Army Air Forces cadets is recorded. Some comments are included which stress the difficulties and importance of the work being done by these civilian instructors. *Flying*, December, 1943, pages 74, 142, 3 illus.

Engineers Made to Order. E. V. Gustavson. A compendium of the specialized training programs instituted by the Vega Aircraft Corporation to help remedy the shortage of trained engineers in the aircraft industry. Major importance is centered on the full-time 52-week course in aircraft engineering fundamentals now being given to 40 engineering employees, all female. Designed to furnish the minimum technical education required for the selectees to be upgraded to jobs requiring more experience or training, the classes are taught by instructors of the California Institute of Technology and engineers from Vega. Subjects cover layout practice, mathematics (through calculus), aerodynamics, structures, shop work, and design changes. In addition, there are lectures on process and production engineering, materials, hydraulics, structure design, and stress analysis. Students attend classes full time for 9 consecutive weeks and then return to project work in the company's engineering branch for an alternate 9-week period.

Other training programs outlined in the article include: the orientation of engineers from other industries; short, part-time intensive instruction of Vega's engineering employees, with the purpose of improving their knowledge and skill by outside study; the full-time training of draftswomen; and several short, full-time projects on specialized phases of the engineering work, for draft-exempt employees. Besides the California Institute of Technology, facilities of the University of California were utilized for these courses. *Aviation*, November, 1943, pages 167, 169, 253–255, 257, 3 illus.

Unskilled Labour. Suggestions on the training of inexperienced aircraft workers are offered. Preceded by general advice applicable to all operations, various aspects of specific occupations for which unskilled labor is particularly adaptable are considered. The article includes suggestions for the instruction of workers in the riveting, drilling, sheet metal, welding, assembly, and designing departments. *Aircraft Production*, November, 1943, pages 536–539, 2 illus.

Big Ship Training. Russ Brinkley. A description of how men with 200 hours of flying experience are trained to pilot large aircraft at the Airlines War Training Institute. The article reviews the accomplishments of the air-line schools in the training of pilots for the Army. *Flying Aces*, December, 1943, pages 18, 19, 61, 4 illus.

Warfare

Guns Against Aircraft. Major Gen. Joseph A. Green. The organization and function of the Army's Antiaircraft Command are discussed. The importance of positive protection from the ground against enemy air attack is emphasized. It is stated that antiaircraft strength has been greatly increased during the past 18 months and this expansion is continuing. Facilities for training antiaircraft personnel and units, most of which have been developed during the current emergency, are described. Training methods and antiaircraft guns and equipment are discussed. *Army Ordnance*, November-December, 1943, pages 549–551, 2 illus.

Uebertragungsgeraete fuer die Flakartillerie (Translator Instruments for Antiaircraft Artillery). H. Hopf. A description is given of the construction and operation of instruments used for the control of antiaircraft artillery. These instruments, called translator instruments, are used to transmit continuously and rapidly the three types of data required for firing antiaircraft guns—deflection, gun elevation, and fuse setting—from the station control to the guns. These instructions are transmitted electrically and are recorded at the guns. In the same manner the calculated opti-

(*Continued on page 143*)

"Cat" landing on AEROLS*

Affectionately known as the "Cat," Consolidated Vultee's amphibian airplane, which is named the Catalina, is in the news almost constantly on both our eastern and western battle fronts.

More than an abbreviation, "Cat" aptly suggests this plane's easy grace in landing. The Catalina lands with the legendary surefootedness of the cat because it is equipped with Aerols.

Aerols are an *established* advancement in aircraft safety and comfort. To cushion landing shock, Aerols are used not only on Catalinas, but on most types and sizes of American aircraft.

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AEROLS

*THE SHOCK ABSORBING UNITS ON AN AIRPLANE'S LANDING GEAR. THE NAME IS DERIVED FROM THE WORDS "AIR" AND "OIL"—THE FLUIDS USED TO DISSIPATE THE LANDING SHOCKS

Government Publications

Army Air Forces

Return from Combat. A description of how the Army Air Forces have set up a redistribution program for handling personnel coming back from the war zones. A chart is presented showing the flow of A.A.F. personnel returned from overseas. *Air Force*, December, 1943.

AN Specifications. A loose leaf book of 150 pages is intended to give graphic information that will be helpful to contractors in the preparation of manuscript and art work in technical handbooks. An attempt has been made to show the contrast between good and poor styles of preparation. The material was originally prepared for use in a slide film, to which has been added clarification of the slide-film material. The book is extensively illustrated by photographs, drawings, and charts. The sections include: photography; operational views; retouching; cutaway; exploded views; line drawings; shading mediums; index numbers; and color. *Air Service Command, Maintenance Data Section.*

How to Use the Astro-Dome. Col. Thomas L. Thurlow. In this article the writer gives information for aircraft navigators on the operation of the astro-dome. The article deals in particular with the use of the astro-dome in the navigator's compartment of medium and heavy bombers, and in cargo transport planes. *Air Force*, December, 1943.

Our Developments in Firepower. Col. Frank C. Wolfe. Accomplishments in the development of fire power for American fighting planes are outlined. Recent fire-power developments are listed. Pointing out that the fire-power problem as applied to aircraft is not new, the author traces the various steps that have been taken in converting the airplane into an efficient military weapon and discusses the armament of modern aircraft. *Air Force*, December, 1943.

Wings for the Wounded. Lt. Col. Richard L. Meiling. The growth of the Medical Air Evacuation Service which, it is stated, has moved more than 100,000 battle casualties since the Pearl Harbor attack, is traced. The operation methods of the Medical Air Evacuation Squadrons are described briefly, with notes on the personnel and equipment. Reference is made to the beginning of air transportation of the wounded in the first World War. *Air Force*, December, 1943.

Catalog of Available Material of the Army Air Forces. A catalogue has been issued listing some of the many items which are at present in excess of the needs of the Army Air Forces. These items are offered for sale by the Air Service Command and are available to manufacturers and their suppliers, under existing regulations. Among the items listed are aircraft-engine parts, airplane accessories, tools and equipment, and flying clothes. *830th Army Air Force Specialized Depot*, Memphis, Tenn.

Prepare for Ditching. A summary of aircraft "ditching" procedures prepared by the Office of Flying Safety in cooperation with the Bombardment Department, A.A.F. School of Applied Tactics. The article describes how the chances of men surviving an emergency landing at sea are enhanced by constant drill in proper procedure and by the lifesaving equipment provided. *Air Force*, December, 1943.

Black Light. S. M. Burka. An explanation is given of the invisible rays that illuminate instrument dials in the cockpit to protect the night vision of pilots and to keep the cockpit dark, thereby preventing disclosure of the plane's presence and position to enemy aircraft.

Present instrument dials emit a pale greenish light reflection that continues to glow after all light sources have been eliminated. Discovery of a new stable luminescent material that is fluorescent but not phosphorescent now enables instantaneous black-out of all dials. This material, developed to emit an orange reflection as further protection for the pilot's night vision, is being applied to all new instruments as rapidly as manufacturers can change over. *Air Force*, December, 1943.

Civil Aeronautics Administration

Determination of Means to Safeguard Aircraft From Powerplant Fires in Flight. Part I. A. W. Dallas and H. L. Hansberry. The problem of providing adequate fire protection, in flight, for modern, tightly cowled, air-cooled radial aircraft power-plant installations of conventional design was attacked experimentally. A full-scale, operating Douglas DC-3 engine-nacelle-wing combination was constructed and placed in a controlled air blast to simulate actual flight conditions. Quantities of gasoline and oil were ignited at locations throughout the power-plant installation where fire might occur as a result of failures of the engine or the fuel or oil systems.

The test procedure consisted of four phases of investigation: (1) fire detection, (2) fire extinguishment, (3) effect of fire on materials, and (4) sources of ignition.

The detection tests proved that quick, positive fire detection of gasoline and oil fires is practical. Design criteria for detectors in the power-plant installation are given.

The extinguishing tests showed that the extinguishing of fuel and oil fires in flight is practical within certain limitations of fire size and duration. Such limitations arise primarily from the necessity of using extinguishing systems of reasonable size and weight. In addition, the tests resulted in an evaluation of various fire-extinguishing agents, the determination of optimum methods of application of the agents to the power plant installation, and the establishment of correct operating conditions during extinguishment. Criteria for the detailed design of fire extinguishing systems are presented.

The tests on materials were confined to the actual materials and equipment comprising the test setup. During oil and gasoline fires of various sizes and in various locations, temperatures of cowling, wing, and nacelle skin and the firewall were recorded. In addition, observations were made of the general effect of fire on the oil and gasoline systems, the engine accessories, the oil tank and cooler, the engine mount, the landing gear and tire, and miscellaneous components. The superiority of steel over aluminum alloy in locations of high temperature and the ability of filled oil systems to withstand serious fires were clearly indicated in the tests.

The ignition tests were conducted to determine the possibility of spontaneous ignition of fuel and oil. The tests clearly indicated that ignition sparks, exhaust system muffs for obtaining carburetor heat, or cracks and openings in the exhaust system are possible ignition sources. These tests also showed that spontaneous ignition would not occur on unmuffed exhaust systems in good condition.

In general, the methods developed to provide adequate power-plant fire protection in flight, and variations of

these methods, should lead to practical solutions of the problems encountered in this field of fire protection. *Preliminary Technical Development Report No. 33*, September, 1943.

Calibration of a Permanent Control Beacon for a 300-Meter Photometric Range. T. H. Projector. A report describing the development and the results of a series of calibrations of a portable projector for the purpose of providing facilities for calibrating a permanent control beacon. This beacon was installed on a 300-m. outdoor photometric range at the National Bureau of Standards. Its calibration involved determinations of atmospheric transmission and required a portable standard light source with sufficient intensity to be measured photometrically at the distance employed. *Technical Development Report No. 391*, September, 1943.

A Study to Determine the Maximum Weights Permitted by the Transport Category Requirements for the Douglas DC-3 Airplane. In response to a request from the Air Transport Command of the Army Air Forces, the Civil Aeronautics Administration considered the possibility of authorizing increased weights on the airplanes used in scheduled air-carrier operations.

The study was undertaken to determine the magnitude of any such increase in weight permitted by the performance requirements of the transport category for the Douglas DC-3 when equipped with Pratt & Whitney S1C3G and Wright G202A or G102 engines. It is the purpose of the report to describe the work done and the results obtained.

These results have indicated that the landing weight for all engines considered and the take-off weight for S1C3G and G202A engines may be increased above those previously authorized (24,400 lbs. for landing and 25,200 lbs. for take-off). In view of this, it has been recommended to the Civil Aeronautics Board that the Civil Air Regulations be so amended as to grant to any air-carrier airplane such weight as may be so obtained. *Flight Engineering Report No. 9.*

Index for Chapter XVIII of Inspection Handbook, and Current Specifications, Notes and Bulletins. The Aircraft Engineering Division has prepared a revised alphabetical index of approved aircraft, dated October 1, 1943, together with a numerical list of current aircraft, aircraft engine, propeller, appliance, product, and process specifications; airworthiness maintenance inspection notes; air worthiness maintenance bulletins; and a list of pages of Chapters XVIII, XIX, and XX, revised to date. *Safety Regulation Release No. 151.*

The Effect of Air Temperature Upon the Rate of Climb of an Airplane Equipped with a Constant Speed Propeller is the title of Flight Engineering Report No. 12, prepared by the Flight Engineering and Factory Inspection Division, primarily for the use of the Division but made available for the benefit of others doing similar work.

The report covers the derivation of equations by means of which the effect of air temperature upon the rate of climb may be calculated. It applies the equations to a typical airplane and describes the significance of the results of the application. The derivation is based upon the fundamental equation for rate of climb; upon the generally accepted relationship between the brake horsepower output of an engine and the temperature of the air involved in the carbureting, cooling, and supercharging processes; and upon a rational treatment of the effect of outside air temperature upon propeller aerodynamic characteristics. No new experimental data are contained in this report.

The equations are believed useful for the purpose of calculating the effect of temperature upon a rate of climb determined by testing at a given temperature and require for their application the establishment of certain engine characteristics normally available in the standard engine power output and certain propeller characteristics. *Safety Regulation Release No 153*, November, 1943.

Cracking of Wood Wing Spars in Airplanes Operating in Arid Regions.

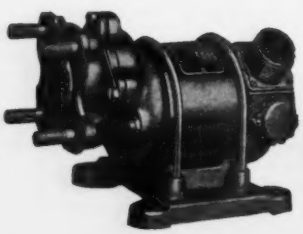
A Message to Engineers and Designers

WHO HAVE A MOTOR PROBLEM

★ When called in on a special application motor problem we are fully conscious of the responsibility placed on us by the manufacturer. In cooperating with his engineers or completely handling the problem in our own engineering department, we keep constantly in mind the motor characteristics which will insure the most successful operation of the equipment.

Our first responsibility is to design a motor best suited for the particular application. This we term *thorough engineering.* Exacting manufacture of the motor, based on long experience in the special application field, is our second responsibility to insure thoroughly dependable operation of the equipment.

THE BLACK & DECKER ELECTRIC CO. • Kent, Ohio

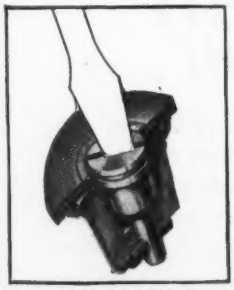


THOROUGH ENGINEERING is the basic factor behind the successful operation of this aircraft fuel pump motor and many other special application motors we have designed for all types of equipment.

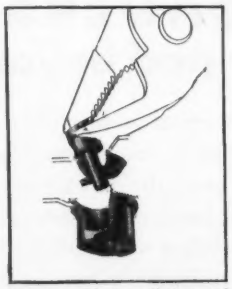
Black & Decker

FRACTIONAL HORSEPOWER SPECIAL APPLICATION MOTORS

ASSURANCE



Camloc high speed fasteners operate with a quarter turn of the screwdriver. They secure doors and access panels in metal, plastic or plywood.



Stud Assembly is easily inserted or removed as a unit. Selection of correct size at final assembly allows for cumulated tolerances. Cross pin is permanent.

A complete line permits selection of Cam Collar exactly suited to the application. Floating type allows up to 1/8" alignment in any direction.

CAMLOC'S stud head clearly visible 1/8" above the panel indicates that the fastener is unlocked. A flush stud head gives assurance that Camloc has secured firmly, the members to which it is attached. Many such unique features make Camloc High Speed Fasteners an important part of today's fighting aircraft. Camloc eagerly awaits the day when this modern method of securing doors and access panels will be available to peacetime products of metal, plastic and plywood. Write for catalog.

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CONTINUING LEADERSHIP
. . . through the war and beyond!

The start of the new year finds instrument headquarters still *busy at it* in the final drive for victory. Dependable WESTON instruments, in all familiar types, continue flowing in unprecedented quantities to every battle front. *In new types, too;* for all during this period of stress WESTON development laboratories also have *led the way* . . . continually meeting the new measurement problems of this mechanized war. Thus when instrument priorities are relaxed, WESTONS will continue as industry's *standards* for all measurement needs. For, *new* measurement tools as well as *old* will be available in their most *trustworthy form* . . . here at instrument headquarters. Weston Electrical Instrument Corp., 625 Frelinghuysen Ave., Newark 5, N. J.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.

FOR OVER 55 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

A study prepared by the Aircraft Engineering Division shows that many airplanes of various models having wood spars and being operated in arid regions have developed longitudinal spar cracks in the vicinity of the plywood reinforcing plates. These cracks result from the tendency of the spar to shrink when drying takes place. The cross-grain portion of the plywood resists this tendency and causes a cross-grain tensile failure in the basic spar. The causes and effects of the incidence of cracks are explained. It is stated that the amount of plywood at a given point on the spar is the controlling factor, and other factors are: (1) poor protective finishes, (2) large cutouts, and (3) metal fittings that utilize two lines of large-diameter bolts. The survey tells how these defects can be overcome. *Safety Regulation Release No. 154.*

The Information and Statistics Service of the Administration has issued a report on a new apparatus for revealing diplopia, or double vision, in men being tested for aircraft pilot certificates. With the new apparatus combinations of four white and four red lights thrown on a ground-glass screen provide 26 possible combinations of light. This apparatus is designed to prevent the possibility of the applicant under test deceiving the examining physician.

Civil Aeronautics Board

Here's a Trainer You Can Build Yourself. Instructions are given for the construction of a "flight" trainer, built at an almost negligible cost, in which to practice spins, figure eights, stalls, etc. The idea that such a trainer was needed was suggested to the staff by a book on flight maneuvers issued by the C.A.A. Builder's diagrams for this homemade trainer are shown. The directions cover the building of the fuselage, wings, controls, and tail assembly. *Civil Aeronautics Journal,* November 15, 1943.

The Aeronautical Board

Army-Navy Aeronautical Standards, new and revised, have been issued recently on a variety of materials, including slide fasteners, ball-and-socket joints, aircraft nuts, tube clamps, solderless terminals, hose nipples, hose assemblies, toggle switches, light assemblies, conduit couplings, adapter bushings, dehydrator plugs, and flexible-shaft assemblies for hand-crank starters. Other materials covered are thermocouples, compass-correction cards, oxygen-mask tube assemblies, carbon-dioxide cylinders, hydraulic directional-control valves, filters, flying helmets, instrument identification plates, and map cases.

New and revised Army-Navy Aeronautical Design Standards cover tolerances for stainless-steel bar and rod; tolerances for corrosion-resisting steel plate sheet and strip; and case-standard dimensions for dial instruments.

Naval Aircraft Factory Standards also have been issued recently on electrical-equipment nameplates, fuel and oil-tank filler units, parachutes, parachute seats, microphone switches, and trigger switches.

The monthly index of Army-Navy Aeronautical Standards gives an alphabetical list of materials, with their AN numbers and the Army and Navy numbers which they supersede for aeronautical use. *Working Committee of the Aeronautical Board.*

Navy Department

Summary of Regulations Governing the Issuance and Wearing of Decorations, Medals and Ribbons Now Designated for Naval Personnel. A description of the decorations awarded by the Navy for different achievements. Information is given on the different campaigns for which medals are issued. *Bureau of Naval Personnel Information Bulletin 15016,* issue of March, 1943; revised June, 1943, $0.10.

Quartermaster Department

Three loose-leaf volumes constitute a part of the syllabus, textbook, and supplement used in connection with a course of instruction in map reading and field operations.

The book, intended for use by the instructor, contains an outline of the course. The purpose of these courses is to turn out students sufficiently skilled in supply and other operation principles so that they can carry out other assignments properly and efficiently.

The textbook for the use of students gives detailed instructions on the established methods of making, reading, and using military maps, and Supplement Number One covers the general principles of camouflage and information on the materials used and their cost, for estimating quantities and values of materials needed for such purposes.

A considerable part of the course is devoted to aerial photography and the use of maps made by aerial photographic methods. *The Quartermaster School,* Camp Lee, Va.

War Department

Pre-Induction Vocational Training in Aircraft Maintenance. Detailed information on Army needs for specialists in aircraft maintenance is contained in a bulletin for teachers and supervisors prepared jointly by the War Department and the Vocational Division, U.S. Office of Education.

It presents suggested units of instruction from which the teacher may select those feasible for his shop and suited to the needs of individual students. Sections of the bulletin cover the Basic Requirements of Training in Aircraft Maintenance; Army Aircraft Specialists; Suggestive Units of Instruction in Aircraft Maintenance Adaptable to Vocational Classes; and Planning Pre-Induction Training in Vocational and Industrial Classes. *PIT-333;* U.S. Government Printing Office, Washington, D.C., 1943, $0.10.

Airplane Inspection Guide. A manual written for the purpose of furnishing airplane mechanics, inspectors, and other maintenance personnel with necessary information on the inspection of airplanes, airplane engines, and auxiliary equipment. Supplemented with the references indicated, the manual provides the reader with the knowledge needed to fulfill the requirements of the various periodic inspections included in the visual inspection system for airplanes. The instructions cover what to inspect and when but not the details of how to inspect or repair. *Technical Manual No. TM1-415,* August 17, 1943, $0.25.

War Manpower Commission

Intra-Industry Transfer and Upgrading Suggestions for Occupations in the Airframe Industry. This publication, which is one of the "Job Family Series," is designed to facilitate the systematic transfer and upgrading of workers within the air-frame industry. It contains transfer and upgrading suggestions for approximately 550 production occupations in this industry. *Job Family Series No. I-40, Worker Analysis Section,* April, 1943.

War Production Board

Salvage Manual for Industry. A manual has been issued on salvage methods and practices for segregating and preparing secondary waste materials. Sections of the manual deal with organizing and planning, administrative factors, salvage practice for metal scrap, nonmetallic waste, and case histories. *Technical Service Section, Industrial Salvage Branch, Salvage Division;* for sale by Superintendent of Documents, Washington, D.C., $0.50.

British Information Services

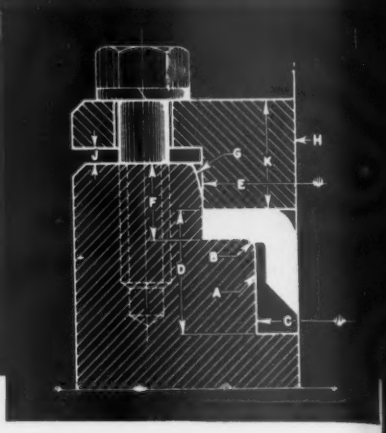
A Philosophy of Aeroplane Strength Factors. A. G. Pugsley. A report of a preliminary attempt to bring airplane structural strength and loading statistics together into a logical and practical philosophy of strength factors. By correlating such statistics with structural accident rates, the influence of various design parameters is demonstrated and a new view of some past difficulties is obtained. *Ministry of Aircraft Production, Aeronautical Research Committee, R. & M. No. 1906,* British Information Services, New York, $0.40.

The King's Regulations and Air Council Instructions for the Royal Air Force. An annual reprint of a publication of the British Air Ministry containing regulations and instructions for the Royal Air Force. It embodies amendments promulgated in Amendment Lists Nos. 1 to 116. $2.15.

GRATON & KNIGHT ENGINEERS

Present

PACKINGS POINTERS



THE FLANGE (or "Hat") PACKING

The flange packing is self-sealing at its inside periphery — just the opposite of a cup packing.

With rare exceptions, it has only one application — in a packing recess, to prevent the passage of the medium along the shaft or piston rod.

It is installed with the sealing lip facing the pressure medium. Sealing contact between the piston rod and the inside periphery is maintained by the pressure of the medium in the system; sealing contact between the flanged surface and the stuffing box is provided by tightening the gland on the flanged area.

The flange is most successfully applied where the pressure is not too great. Typical applications are as a dust seal, oil seal or wiper. It has the advantage of being removable for reinstallation; the conventional metal-encased retainers which are pressed into a housing, are usually destroyed by removal.

MAIN ADVANTAGES

1. ***Low first cost.*** Also: machining is simple; no special finishing required for surfaces of packing recess and gland. 2. ***Minimum space.*** 3. ***Easy installation.*** Flanged part of packing is mechanically sealed by tightening the gland. 4. ***No rotation.*** Flange, compression-sealed with gland, has only one mechanical sealing surface (the inside periphery). No danger of packing rotating with rotating shaft.

DESIGN FEATURES

A. Packing Recess

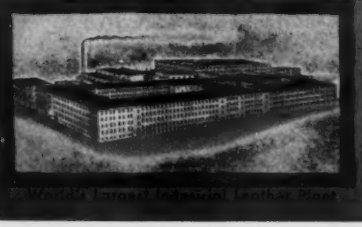
1. Outside diameter (E): equal to outside diameter of packing.
2. Inside diameter (G): equal to shaft diameter plus 2½ times thickness of leather. This allows clearance (A) between vertical wall of recess and flange equal to approximately 25% of packing thickness, to prevent binding and for ease in assembling.
3. Depth (D): equal to overall height of packing plus (usually) 1/16 of an inch. The extra clearance allows free admission of the medium to the packing recess.
4. Depth (F): enough to center the gland or packing follower.
5. Corner (B): chamfered or rounded to avoid cutting the packing.
6. Corner (G): chamfered.

B. Gland (or Packing Follower)

1. Bolted Gland (Fig. 1): Clearance (H) between inside diameter of gland and the shaft must be minimum, in order to give the flange proper backing . . . depth of gland (K) should be sufficient to insure enough clearance at (J) so that tightening the bolt will develop a compression seal on the base of the packing. If clearance is excessive at (H), a metal washer can be installed to properly support packing.
2. Threaded Gland, with protective washer between flange and gland, to prevent distortion of flange by tightening of gland.

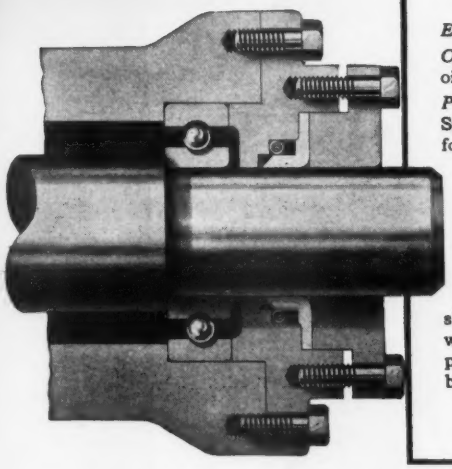
C. Expanders (actually "contractors", in case of flanges)

1. Finger Type Expander: phosphor bronze type is most efficient, but is usually limited to production jobs.
2. Garter Type Expander: coil spring easily wound on an ordinary lathe.
3. Miscellaneous Expanders: rubber or synthetic rubber, braided flax, hemp, etc.



GRATON & KNIGHT *Engineering*

GRATON & KNIGHT *Recommendations at the* "PACKING POINT"



CASE NO. 1

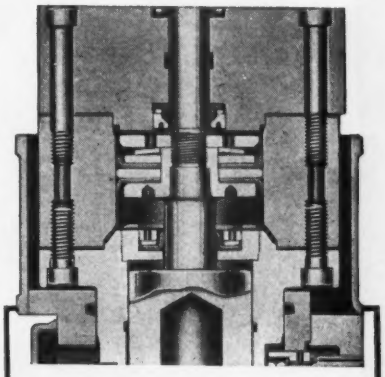
OIL SEAL APPLICATION

Equipment: rotating shaft.

Operating conditions: used as oil retainer with coil spring.

Packing recommended: Spartan leather especially treated for oil.

Accessories: close-wound coil spring, contracting the inside diameter of the packing, keeping it in sealing contact at the sealing point, without causing excessive friction. It will maintain tension even after considerable wear has taken place on the packing. (Spring not furnished by G & K.)



CASE NO. 2

PNEUMATIC APPLICATION

Equipment: retractible head of welder.

Operating conditions: 125 p.s.i. air.

Packing recommended: Spartan leather especially treated for 125 p.s.i. pressure.

Accessories: In accordance with recommended practice under Fig. 1.

See Graton & Knight Insert in SWEET's File for Product Designers

SPARTAN LEATHER PACKINGS AND A SERVICE THAT BUILDS CERTAINTY AT THE POINT OF SEAL

Graton & Knight's SPARTAN emphasizes the many advantages of leather as a packings material —

wearing quality . . . low coefficient of friction . . . flexibility at low temperatures . . . adaptability to wide range of mediums . . . economy

and adds the following qualities, which result from the exclusive Graton & Knight SPARTAN tannage —

the resistance to heat and oil of top-quality chrome leather . . . a mellowness, flexibility and body not found in the usual chrome tannage.

Spartan has highest resistance to heat (withstands boil test), and will not dry out hard and brittle. It is acknowledged the top-quality leather in the packings industry.

The combination of proper selection of sealing material plus correct application has made Graton & Knight engineers the No. 1 source of practical, time-saving aid for machine designers.

When your design reaches the "packing point" — or when a packing trouble arises — call on G&K engineers.

the hand that builds certainty at the point of seal

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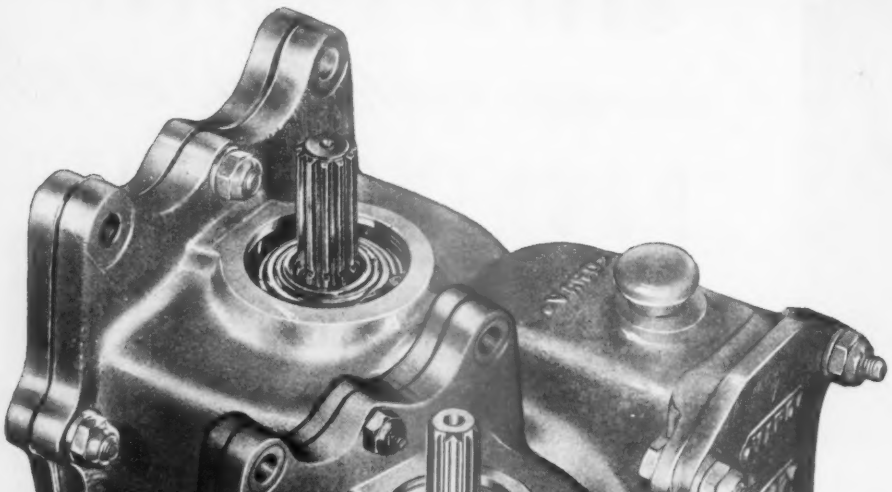


BALL BEARING GEAR TRANSMISSION FOR PLANE OR PLANT

This VARD gear transmission was originally designed as a junction box to be used for manual emergency operation of a line shaft in aircraft. Simplicity of construction and light weight were necessary because of this initial aircraft application. Now it has been found that this powerful small gear unit may be used industrially to drive two operating units from a single motor. The VARD gear transmission may be connected either parallel or at right angles to power source. The distance between the centers of shafts in illustrated gear box is 2½ inches. It is designed for horizontal mounting. There is no gear reduction in this particular transmission. Attachment shafts are supplied with a 24-48 pitch, 11-tooth involute spline with a 30-degree pressure angle. This unit was designed for a maximum torque of 900 inch lbs., weighs a total of 3½ lbs.

VARD produces aircraft hydraulics, aircraft geared parts and aircraft inspection equipment—to Gagemakers' accuracy.

Call us for high precision aircraft parts—and quantity delivery.

VARD INC.

PASADENA 8, CALIFORNIA

The Aviation Annual of 1944

Edited by Reginald M. Cleveland and Frederick P. Graham

Contents: The United States Army Air Forces; Naval Aviation; Aviation Training in the United States; Aircraft Manufacturing in the United States; Aeronautical Research, an Indispensable Element of Air Power; The Civil Air Patrol; Commercial Airlines of The United States; American Air Transport; The Aviation Annual Directory; Aviation Books.

The issue of this handbook dated 1944 gives the aeronautical record of the year 1943. With introductions to each section written by leaders in their respective fields, the whole range of aviation activities in the United States during the past year is described and illustrated with the skill of trained observers and writers. The Annual has been prepared under the supervision of Aviation Research Associates, which insures a double checking for accuracy and scope.

This Annual will become recognized with each succeeding volume as an invaluable history of the progress of all phases of aeronautical development in this country. Its directory of aircraft companies and organizations and the annual bibliography add to its usefulness as a reference book. Doubleday, Doran & Company, Inc., Garden City, N.Y., 1943; 224 pages, $3.50.

Methoden der Mathematischen Physik (Methods of Mathematical Physics) Vol. II

R. Courant and D. Hilbert

This volume presents parts of the theory of partial differential equations which are related to physics. Subjects that may contribute something to the form of the matter of representation are discussed. The aim is to render important branches of analysis more accessible and more lucid and also to pave the way for further investigations.

According to the authors, the classic ideal of a so-called atomistic conception of mathematics requires that the matter be condensed in the form of suppositions, statements, and proofs. In doing so, the inner relation and motivation of the theory is not directly the subject of the representation. In a complementary manner a mathematical system may be considered as a continuous web of relations in the description of which method and motivation occupy the foreground. The crystallization of views into isolated, sharply outlined statements plays only a secondary part. This second view has been given preference in cases where a synthesis of both views appeared impractical.

A detailed index provides a clear guide of the contents of the book. Berlin, Verlag von Julius Springer, 1937; published and distributed with the consent of the Alien Property Custodian by Interscience Publishers, Inc., New York, 1943; 549 pages, $8.00.

Books reviewed in this section may be borrowed without charge from The Paul Kollsman Library, Institute of the Aeronautical Sciences, 1505 RCA Building West, 30 Rockefeller Plaza, New York 20, N.Y.

Target: Germany

Contents: Mission 95; From Five Miles Up; Act I, Scene I; Luftwaffe Over Lille; Twelve Feet of Concrete; Parlous Days; Target: Germany; Battles in the Sky; Men, Mud and Machines; The Old One-Two; The Log of the Liberators; Full Stride; The Summing Up.

This is the Army Air Forces' official story of the Eighth Bomber Command's first year over Europe. It is illustrated by excellently chosen pictures and diagrams. Royalties will go to the Army Air Forces Aid Society. There are many excerpts from official communiques and all of the important raids are described in detail.

Although there have been newspaper and magazine accounts of most of the activities of the Command, this is the first authoritative and complete record of the effective results of the bombing of the Continent by our airmen. It is a record of the skill, courage, and determination of our pilots, and it will be read with a glow of pride and confidence in the future of this important development in the war. Simon & Schuster, New York, 1943; 121 pages, $2.00.

The Aircraft Annual 1944

Edited by David C. Cooke

Contents: War in the Air; The U. S. Army Air Forces; The U. S. Navy Air Service; Late Military Developments; American Air Transport; The Doolittle Tokyo Raid; The Strategy of Bombing; What's New in the Air; The Light Plane in War; Miscellaneous Activities; The Manufacturing Industry.

This new year book is a running comment on the aviation events of the current year. It uses many excerpts from newspapers and addresses to make the point of view more personal. It is a presentation for the general public rather than the specialist. The illustrations are carefully selected and give a pictorial record of the progress of aeronautics for the year. Such reviews will be of great value for future historians, as they contain essential source material. Robert M. McBride & Company, New York, 1943; 288 pages, $3.00.

Man in the Air

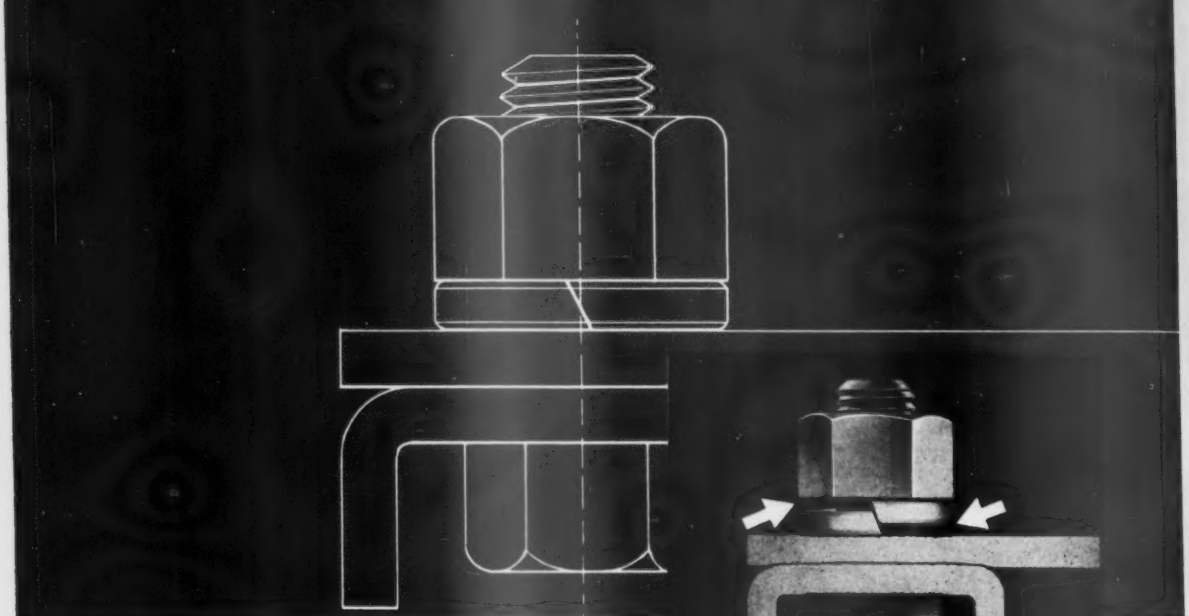
Herbert S. Zim

Chapters: Man in the Ocean of Air; The Air in Which We Live; Our Bodies; Adjustment to Temperature; Respiration and Breathing; Oxygen and Oxygen Masks; Present Day Oxygen Masks; Aeroembolism; Pressure Suits and Pressure Cabins; High Up on the Ground; Changes in Speed and Direction; Positive and Negative Acceleration; Eyes to See; Ears to Hear; Ears Are for More than Hearing; Air Sickness; Flying Fatigue; Smart Enough to Fly; Tests and More Tests; Keeping Physically Fit; Safety in Flight; Flying and Public Health.

This book emphasizes the human factor in flight and the effects of flying on the human body. Although it is in the field usually termed aviation medicine, it is much broader and avoids the use of troublesome medical terms. It also gives a broader interpretation of physiology by the introduction of related scientific material. The layman, the pilot, and the air surgeon will all find useful suggestions in the study of man and his physical reactions while in the element which is comparatively new to him.

The effects of temperature, oxygen want, pressure and acceleration on the body, the eyes and the ears are described with many illustrations. The limitations of the human body and its relations to the new forces that are encountered at high speeds and high altitudes give the aeronautical engineer warning that in postwar flying many new considerations will have to be understood so that the airplane will not outstrip the physiologic limitations of the pilot. Harcourt, Brace and Company, New York, 1943; 332 pages, $3.00.

To Draftsmen, Engineers and Designers



The illustration at the right shows the inevitable wear that occurs in use.

In war time fundamentals are important, this is a fundamental

Many devices can lock a nut on a bolt so that **the nut cannot** turn. But that alone is not sufficient.

Many constructions – so bolted – will loosen because of bolt stretch, and the frictional wear of metal on metal, burrs, flares, and the pulverizing of paint, scale and rust.

Since the advent of the castellated nut, research has found that looseness is usually caused by ductility, and wear at every contact point of metal surfaces.

From an engineering point of view, nut **locking devices** – although they may keep the nut from turning – do not and cannot give the necessary spring reaction that keeps bolted assemblies tight. **Vibration** and **stress loosen everything** – they always have and always will.

You **must** use a spring which **expands as wear occurs. Expanding spring power retards initial wear, then compensates for later wear, and holds parts tight** for a **long period** of time. **A strong spring does it – nothing else can.**

So **with** or **without** a nut locking device specify spring washers on every bolted construction you design.

The **live spring** gives you safety, economy, and efficiency.

Kantlink spring washers are strong, nontangling, helical springs with wide and ample reactive power – (spring expansion).

There is no substitute as economical. No fixed nut nor any short range multi-toothed washer can possibly equal the great holding power of a **long range live spring** – a big helical spring such as Kantlink.

Write today for a descriptive folder.

NATIONAL LOCK WASHER COMPANY
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KANTLINK TRADE MARK

the long-range Spring Washer

Aircraft Engines

Emanuele Stieri

Chapters. Part I, Engines: Airplane Engines; Factors Affecting Engine Performance; Types of Aircraft Engines; Factors Governing Efficient Design of Airplane Engines; Construction of Airplane Engines; Principles of Engine Cooling and Lubrication; Carburetion; Ignition; Fuels and Fuel System; General Description of the Wright Cyclone 14; General Description of the Allison Engine; Description of Pratt & Whitney Engines; Description of the Ranger Engine; Engine Maintenance and Servicing; Propellers. Part II, Engine Instruments: Centrifugal Tachometers; Magnetic Tachometer; Weston Electric Tachometer; General Electric Tachometer; Engine Gage Unit; Manifold Pressure Gage; Remote Indication Autosyn System; Autosyn Flowmeter; Pressure-Warning Units.

Aircraft Instruments

Chapters. Part I, Engine Instruments: Centrifugal Tachometers; The Magnetic Tachometer; Weston Electric Tachometer; The General Electric Tachometer; Engine Gage Unit; Manifold Pressure Gage; Autosyn System of Remote Indication; Autosyn Flowmeter; Pressure-Warning Units. Part II, Navigation Instruments: Compasses; Magnesyn Remote Indicating Compass; The Aircraft Sextant; The Pioneer Drift Meter; Sperry Directional Gyro and Gyro-Horizon Indicators. Part III, Flight Instruments: Instruments for Measuring Atmospheric Pressure; The Pitot-Static Tube; Simple Altimeters; Sensitive Altimeters; The Rate-of-Climb Indicator; The Pioneer Turn and Bank Indicator; The Air Speed Indicator; and The Sperry Gyropilot.

Aircraft Welding

Chapters. Part I: Welding Equipment; Hand Tools Used by the Aircraft Welder; Materials Used in Aircraft Welding; Welding Terms; Welding Symbols and Their Use; Setting Up and Operating; Procedure Control for Aircraft Welding. Part II: A Complete Course in Oxyacetylene Welding of Steel Aircraft; Testing—Apparatus and Applications; Recommended Safety Rules; Welding Rods; Suggested Exercises. Part III: Electric-Resistance Welding; Brazing Aluminum and Aluminum Alloys.

These three volumes comprise part of a series of "Essential Books."

Aircraft Engines is devoted to a discussion of the basic principles and maintenance of aviation engines—both radial and in-line engines. The subjects of carburetion, fuel systems, and ignition systems are discussed, as well as engine instruments and propellers. The text is written in easy-to-understand language.

Aircraft Instruments deals with the instruments used by the pilot and navigator. Each instrument is described in the order of its importance and the principles involved in its operation and maintenance are explained.

Aircraft welding is a manual covering the various phases of welding as applied to aircraft. The book describes welding techniques, and the equipment used in welding. Information is given on the weldability of metals. A chapter devoted to safety rules and safety equipment is included. Duell, Sloan and Pearce, New York, 1943, 392 pages, $1.50; 312 pages, $1.50; 326 pages, $1.50.

Flying Power

C. J. Hylander

For those who wish to learn more about aircraft engines, their construction and operation, this book will give the essentials in nontechnical language. The author has had long teaching experience and knows what a beginner needs and how to present the subject so that he can understand it. He takes the engine apart and shows what makes it operate. The textbook is written for students who may have had no previous knowledge of internal-combustion engines and will be useful in giving primary instruction to the many cadets and mechanics who are entering service. The Macmillan Company, New York, 1943; 164 pages, $2.00.

Modern Airfield Planning & Concealment

Merrill E. De Longe

Contents: Bombardment Objectives; Enemy Eyes Take Wings; World Through the Bombardier's Telescope; Avoiding Telltale Landmarks; Factors Affecting Airfield Location; Natural Concealment Vital; Saving the Terrain Features; Tackling the Landing Field Problem; Planning of the Airfield Facilities; Choosing Proper Color and Texture; Completing the Concealment Scheme; Signals for Friendly Eyes; Looking into the Future.

Heretofore the planning of airfields has been guided by other considerations than concealment from an enemy. The remoteness from the immediate danger of such attack has led to the construction of airports which in case of enemy raids would be prime objectives and easily located. Major De Longe has written this book from a professional point of view. He outlines the role that concealment should have, describes locations easy to camouflage or hide, and then gives in detail the most effective methods of concealment.

This book is timely because of the hundreds of airports that are being built in all parts of the world, which with the foresight described may be made military assets instead of liabilities. The distinction between camouflage and concealment has not been clearly understood, and anyone reading of the need for advance planning as shown by the author will be convinced that, if airfields are expected to be located and designed so as to be as nearly invulnerable as possible to attack, great care must be taken to engage the best professional talent in airport development. Pitman Publishing Corporation, New York, 1943; 167 pages, $4.00.

Meteorology Workbook with Problems

Peter E. Kraght

Chapters: The Atmosphere; Temperature Variation; Pressure Variation with Altitude; Composition of the Atmosphere; Condensation in the Atmosphere; Temperature and Dewpoint Changes in Rising and Sinking Air; Stability and Vertical Currents; Cumulus Clouds, Showers and Thunderstorms; Visibility in Smoke and Haze; Stratus and Stratocumulus Clouds; Fogs; Local Winds; Gradient Wind Systems; Fronts and Frontal Weather; Wind Friction and Gusts; Weather Observations and Reports; Weather Maps; Answers to Problems; Cloud Forms.

A workbook for students beginning the study of meteorology is intended for those who must approach the subject without the aid of physics and mathematics. Illustrated facts with limited explanation constitute most of the first 14 chapters. The 15th chapter deals with weather observations and symbols and is included for those who need to know how weather reports are assembled and transmitted. Cornell Maritime Press, New York, 1943; 148 pages, $2.25.

Gliders and Glider Training

Emanuele Stieri

Chapters: Highlights in the History of Motorless Flight; Types of Modern Gliders; How and Why a Glider Stays in the Air; The Controls of the Glider and How They Operate; Getting the Glider Into the Air; Flying the Glider; Soaring for Beginners; Air Currents, Wind, and Clouds; Instruments Used for Soaring; Giant Gliders Go to War; Building a Glider Eligible for a C.A.A. License; Rules and Regulations Governing Glider Pilot Certificates and Licenses; The Soaring Society of America; Gliders of the Future.

After years of discouraging lack of interest in gliding and soaring flight in this country, it is gratifying to know that the glider has at last acquired a status entitling it to an excellent book covering the entire field, historically, technically, and prophetically. The historical section traces gliding flight from its legendary beginning to the astonishing records made just before the war started and carries it through the valuable use of many types of cargo and passenger gliders in warfare.

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VINYLITE Plastics have taken a major role on two important fronts... the battle front and the industrial front ...for these reasons:

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Plastics Division
CARBIDE AND CARBON CHEMICALS CORPORATION
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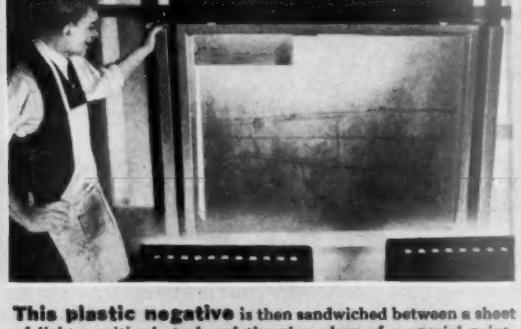
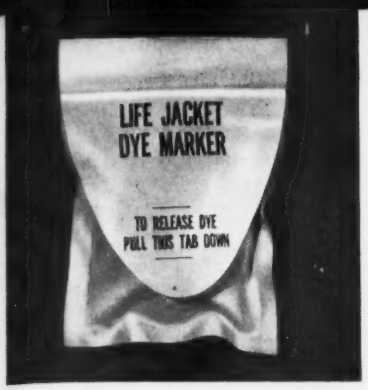
To speed the making of templets for complex aircraft parts, one of America's leading fighter plane manufacturers uses an ingenious method of photographing tracings directly on steel plates. The original drawing is carefully traced on a sheet of VINYLITE Rigid Plastic. The result is an extremely clear, plastic negative.



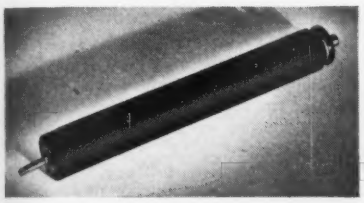
This plastic negative is then sandwiched between a sheet of light-sensitized steel and the glass door of a special printing box. Vacuum draws the three into perfect contact. Then arc lights make a contact print of the templet drawing directly on the steel. Because VINYLITE Plastics are dimensionally stable, no distortion occurs under this sharp temperature change, permitting the image to maintain the absolute accuracy required in the final part.

The final steel print is developed by applying acid and friction. When compared against the tracing on the VINYLITE sheet, it proves to be a perfect reproduction.

After checking the steel plate against the original drawing, it is cut to shape. The entire process, from drawing to templet is completed in only one hour.



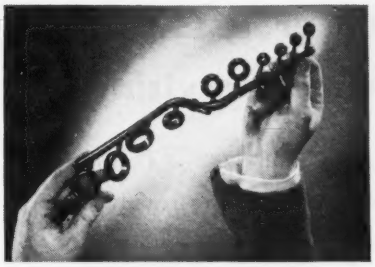
Survivors of sea casualties are easier to spot from a rescue plane now that both the Army and Navy are providing life jackets with special packets containing a "tea-bag" of fluorescent dye. In times of emergency the dye is readily released to spread quickly over a large area of the sea. One problem in the manufacture of these packets was to find a coating and an adhesive that were strong, waterproof, and that would protect the dye at extreme temperatures. The answer was found in a VINYLITE Plastic. Cloth is coated, then instructions are printed on it. The "tea-bag" is inserted and the packet edges are heat-sealed, using the coating as the adhesive.



A manufacturer of machine roll coverings experimented with an extruded tube of VINYLITE Elastic Plastic applied over the metal core. But, with vulcanizing impossible, how could this new material be successfully bonded? The answer came in the form of an adhesive made with VINYLITE Resins. And because VINYLITE Plastics do not oxidize the new platen is proving to be superior to its rubber predecessor.

These two storage tanks contain concentrated sulfuric acid. The temperature of the metal is usually between 90 and 100 degrees F. There is considerable spillage. Under these conditions, ordinary coatings broke down in less than a month. One year ago the tanks were refinished with VINYLITE Resin VMCH air-dry coating. Today, although stained by spilled acid, this coating is unharmed.

Tiny grommets must be made by the thousands to supply the needs of American military planes and trucks. Today these grommets are injection molded of a VINYLITE Elastic Plastic. This conversion saves large quantities of critical rubber, but even more important, it cuts molding time to a fraction of that formerly needed. Scrap and trim can be remolded immediately without costly reprocessing.



Important blueprints became oil stained, wrinkled, and torn in war-plant shops. How could they be made more durable to eliminate this waste? Now a thin sheet of VINYLITE Elastic Film, backed with paper, is laid over the print . . . then ironed on at moderate temperature. The thermoplastic film softens . . . adheres to the print. As soon as it cools the backing paper is stripped off, leaving a strong, glossy, water- and oil-proof coating.

Bomber floor mats and catwalk mats must be skidproof and unaffected by oil. A prominent rubber company, using standard rubber-processing equipment, calendered VINYLITE Elastic Plastics on a cloth base . . . embossed the surface for maximum traction. Since VINYLITE Elastic Plastic requires no curing or vulcanizing these sturdy, skidproof, oilproof mats are made at low cost.

PROPERTIES OF "VINYLITE" ELASTIC PLASTICS—These are a relatively new group of VINYLITE Plastics with rubber-like or elastomeric properties. They are produced in a variety of forms, ranging from soft to semi-rigid. They possess great toughness, and excellent resistance to continued flexing, and to severe wear and abrasion. Tensile strength is higher than that of most rubber compounds. Their electrical insulating properties are outstanding. They are not subject to oxidation. By correct choice of plasticizer, they can be made non-flammable, and highly resistant to water, oils, and corrosive chemicals. They are available in a wide range of colors, either translucent or opaque, or can be supplied in their natural, colorless, transparent state. Since all VINYLITE Elastic Plastics are thermoplastic, no curing or vulcanizing is required. They are more affected by temperature changes than is rubber, but their operating range is wide, some types remaining flexible at —50 deg. F., yet tack-free at 200 deg. F.

VINYLITE Elastic Plastics are supplied as sheeting and as compounds for calendering onto cloth, and for molding and extrusion.

PROPERTIES OF "VINYLITE" RIGID PLASTICS—Produced from unplasticized vinyl resins, VINYLITE Rigid Plastics possess a combination of properties found in no other thermoplastic material. Because of their extremely low water absorption, these plastics remain dimensionally stable under widely varying atmospheric conditions. They have exceptional resistance to alcohols, oils, and corrosive chemicals. They have high impact strength and tensile strength. They are odorless, tasteless, and non-toxic. They do not support combustion. They are available in a wide range of colors, translucent or opaque, and also in colorless, transparent forms. They are supplied as rigid sheets or as molding and extrusion compounds. Rigid sheets can be fabricated by forming, drawing, blowing, spinning or swaging, and can be punched, sheared, sawed, and machined on standard metalworking tools. Molding compounds are suitable for both compression and injection molding. Extrusion compounds give highly finished continuous rigid rods, tubes, and shapes directly from the die.

PROPERTIES OF "VINYLITE" RESINS FOR SURFACE COATINGS—Correctly formulated and applied, VINYLITE Resins yield finishes of unusual toughness, gloss, adhesion, and chemical resistance. They can be applied by spraying, knife-coating, or dipping to a wide variety of surfaces, such as metal, cloth, paper, and concrete. Prepared by dissolving resins in organic solvents, these finishes can be modified with a wide variety of pigments, dyes, and plasticizers. These resins are generally not employed with other film-forming bases, therefore, coatings formulated from them exhibit the desirable features of VINYLITE Resins alone. Drying is solely by evaporation of solvent, and finishes can be either air-drying or baking types.

PROPERTIES OF "VINYLITE" RESINS FOR ADHESIVES—Unusual toughness, resiliency, and impact resistance are characteristic of adhesives made of VINYLITE Resins. These resin adhesives are widely used as bonding agents for such materials as cellophane, cloth, paper, cardboard, porcelain, metal, mica, stone, leather, wood, and plastic sheets and film. They are available as powders for the compounding of adhesives, or as solutions sold under the trade-mark VINYLSEAL. The latter are especially recommended for bonding impervious materials, such as metals, and urea and phenolic plastics. Their bonding strength is comparable to that obtained with soft solder. By the addition of plasticizers, adhesives based on VINYLITE Resins can give almost any degree of flexibility desired.

Vinylite
TRADE MARK

ELASTIC PLASTICS • RIGID PLASTICS
RESINS FOR ADHESIVES
RESINS FOR SURFACE COATINGS

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MEANS greater assembly speed!...faster servicing!

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Stock Cannon Connectors are in use in a wide variety of industries. So great is the diversity that it is difficult to find a requirement in the field of general industry which cannot be met with a standard Cannon product.

The Cannon Catalog Supplement gives a resume of the Cannon Connectors for general use. Drop us a line on your business letterhead and we'll gladly mail you one. Address Department A-105, Cannon Electric Development Company, Los Angeles 31, California.

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REPRESENTATIVES IN PRINCIPAL CITIES—CONSULT YOUR LOCAL TELEPHONE BOOK

All types of modern gliders are described, and what may be considered a textbook on glider operation is included. The specialized meteorologic requirements for soaring flight are outlined. Technical data for the construction of primary gliders add to the completeness of the book, which may be properly termed an encyclopedia of the science and art of motorless flight. Duell, Sloan and Pearce, New York, 1943; 118 pages, $3.00.

Basic Aircraft Construction

Ross A. Peterson and Raymond E. Erickson

Chapters: The Airplane and Its Components; Present Methods of Aircraft Production; The Aircraft Blueprint; Tools, Jigs, and Fixtures; Material Used in Aircraft Production; The Machine Shop; Sheetmetal Preparation and Fabrication; Riveting; Appendix; Trigonometric Functions.

Offered to enable aircraft workers to develop greater skill in production jobs, this manual contains detailed explanations of methods and procedures for various operations connected with the manufacture of airplanes. It is intended to give the new worker a better understanding of the job to which he is assigned and to increase his efficiency by acquainting him with better production methods and timesaving shortcuts. Prentice-Hall, Inc., New York, 1943; 204 pages, $2.50.

Cloud Reading for Pilots

A. C. Douglas

Chapters: Miniature Cloud Atlas; How Clouds Form; Air Masses and Fronts; Convection Clouds; Layer Clouds and Air Mass Movements; Conclusion; A Few Weather Tips.

The author of this book has served as a ferry pilot for two years and before 1939 operated her own gliding club. She acquired a great collection of cloud photographs and around these has written a book that gives some idea of the habits of clouds and their relation to short-term weather forecasting. By limiting the study to clouds it is the author's purpose to give a pilot instructions as to how to recognize changes in weather when they vary from the plan given to him before his flight. She provides a ready warning guide to the ever changing conditions of the air during flights. John Murray, London, England, 1943; 120 pages, 10s.

Plastics

J. H. DuBois

Chapters: An Introduction to Plastics; The Phenolic Plastics; The Urea or Amino Plastics; The Cellulose Plastics; The Acrylic, Vinyl and Styrene Plastics; The Cast Phenolic and Protein Plastics; Other Plastics Materials; Cold Molded Plastics and Shellac; The

This is the sixth of a series of statements by aviation's leaders on THE SHAPE OF THINGS TO COME.

"Let's plan new jobs now for the men who fought for them,"

says C. Bedell Monro, President of Pennsylvania-Central Airlines

"UPON THE CESSATION *of war contracts, commercial activities in the aircraft industry should be extended far beyond pre-war levels.*

"For what of the thousands of trained technicians—pilots, mechanics, radio operators, navigators, meteorologists and others—young men trained by the armed services only for positions in aviation? They will look to aviation for their vocation when the war is over.

"To absorb these young men, an overall but regulated expansion will be needed—with new routes and services prepared now *to go into effect as soon as our soldiers are demobilized.*

"We can insure post-war jobs for them only by constructive *competitive growth. This means free enterprise must rule—not monopoly—for with monopoly comes the tyranny of complacency. We must prepare now to create the opportunity-and-job-filled air world to which our fighting men should return."*

• • •

THUS Mr. Monro calls upon aviation to accept its great destiny. But it is a destiny which requires more than the vision and courage of the aviation industry. It also requires the support and confidence of a waiting "test-pilot-market"—a market of people who (in business or in private living) are habitually first to accept any new idea that signals progress.

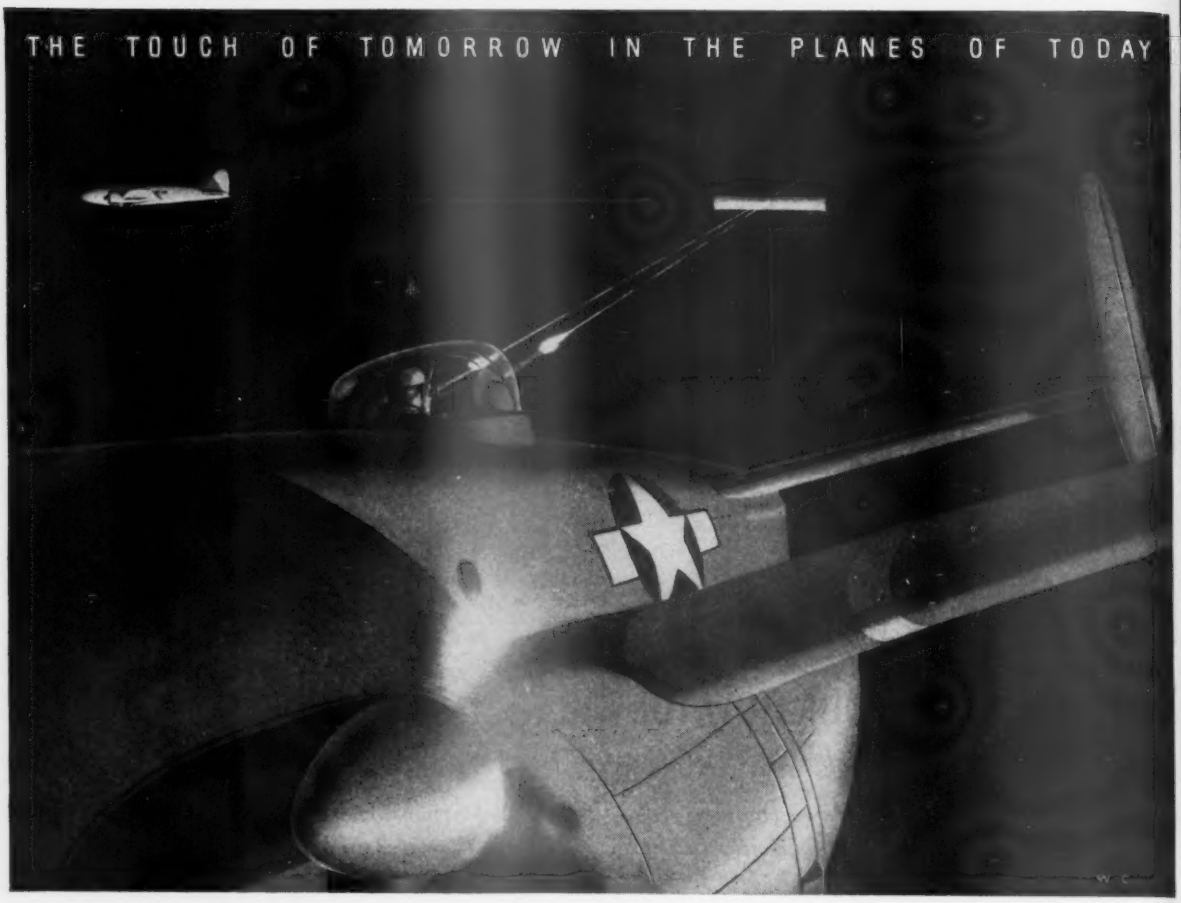
This is the market aviation thinks of when it thinks of the more than a million TIME-reading families—people with the kind of foresight, income and influence that aviation must have to sponsor its ambitious programs—(people able to support with their patronage and prestige any business which executives now in aviation may enter after the war).

Believing that the ideas of aviation's leaders are always of interest to the aviation industry, TIME, the Weekly Newsmagazine, here gives them wider circulation in the name of

AVIATION'S SILENT PARTNERS

TIME

THE READERS OF TIME



It All Adds Up To Subtracting Zeros

Today's apprentice gunner enters a deadly trade—defending American bombers against attacks of Jap Zeros and other enemy fighters.

To follow his trade and survive, the gunner first has to learn how to "polish 'em off around the clock." His training must be thorough and painstaking, and it must come within a hair's breadth of being the real thing. That's why Fairchild developed the GUNNER.

This advanced trainer has the essential characteristics of the bombers from which our student marksmen will soon shoot it out with Axis pursuits. From a power turret, similar to one on a Flying Fortress, each fledgling is taught to pick off tiny targets while moving at better than 200 miles per hour. It's fast, tricky work and it takes a keen eye, steady nerves, precision equipment. It's the kind of training that pays off when the chips are down.

Fairchild's GUNNER, from which apprentice marksmen will step into bombers and thence into action, is one of the largest, speediest training planes ordered by the Army Air Forces. Powered by two 12-cylinder, inverted, in-line, air-cooled Ranger engines, the GUNNER is a typical example of Fairchild's "touch of tomorrow in the planes of today."

BUY U. S. WAR BONDS AND STAMPS

Fairchild Aircraft

Division of Fairchild Engine & Airplane Corporation, Hagerstown, Maryland.....Burlington, North Carolina

Laminated Plastics; Compression and Transfer Molding; Injection Molding and Continuous Extrusion; Finishing and Decorating Plastics Products; Selecting Materials for Molded Products; Design of Molded Products; Synthetic Rubber; Low Pressure Laminating; Trends and Developments; General Properties and Uses for Molded Plastics Materials.

A book written to fulfill the needs of the actual user of plastics and also to serve as a textbook for students. The author discusses the manufacture and use of the more important plastics materials and products, gives tables of their properties, and furnishes basic design information for the designer and engineer. Information is given concerning the history, origin, and recent material sources of plastics and their chemical, physical, and electrical properties and their limitations. Methods of fabrication are dealt with. The book is intended to enable the designer to plan the construction of his products and to give him enough information to take advantage of the important properties of plastics. It is also planned to be useful as a reference book for consultation in the design of a new product or when manufacturing problems necessitate changes in product design. American Technical Society, Chicago, 1943; 435 pages, $3.75.

The Aeronautical Digest of Meteorology

H. M. Webster

Chapters: The Atmosphere; Pressure; Wind; Humidity; Fog & Clouds; North American Air Masses; Characteristics of a Front; Thunderstorms; Ice Formation on Aircraft; General Information; Collection of Data.

This digest is written for the purpose of simplifying meteorology for pilots. Emphasis is placed on the fundamentals of the subject, with the intention to eliminate the more technical aspects. The author makes no claim of originality but offers the book as a digest of the material used by a competent pilot. The pages are mimeographed and numerous free-hand sketches are included. Rochester Business Institute, New York, 1943; 70 pages.

Systematic Wage Administration in the Southern California Aircraft Industry

Robert D. Gray

The seventh study in a paper-bound monograph series constitutes a case study of the technique of job analysis and evaluation which the exigencies of the war are bringing into more general use. The plan described has been developed and applied by the large companies in the Southern California aircraft industry, now composed of Consolidated Vultee Aircraft Corporation, Douglas Aircraft Company, Inc., Lockheed Aircraft Corporation, North American Aviation, Inc., and Northrop Aircraft Inc. The program adopted substitutes a systematic scheme of wage administration for the inconsistent wage conditions that existed in the various companies prior to the application of the plan. The study outlines successive steps in the development of the system and describes the merit-rating plans of the cooperating companies.

Five appendices contain texts and excerpts from other studies of job-evaluation efforts. Industrial Relations Counselors, Inc., New York, 1943; 91 pages, $1.25.

Trail Blazing in the Skies

Shafto Dene

A historical account of Goodyear's progress in the field of aeronautics. The author traces the company's rise from small beginnings to its present position as a primary manufacturer of both complete heavier-than-air and lighter-than-air craft. The development of a practical tire for an airplane 34 years ago is described. How this brought the company into closer contact with the aviation industry, then in its early stage of development, and led the organization to an understanding of the industry's problems and needs is portrayed.

The author discusses airships and balloons, Goodyear's activities in World War I, and postwar progress. Other chapters are devoted to brakes for aircraft, the story of the *Akron* and the *Macon*, light alloys for aircraft, self-sealing gasoline tanks, rubber life rafts, the conquest of static vibration, and lighter-than-air craft in modern warfare. The final 32 pages of the book comprise a picture section containing illustrations of the early days of aviation, balloons, blimps, rigid airships, airwheels and brakes, new naval airships, Goodyear aircraft, and other aviation products. The Goodyear Tire & Rubber Company, Akron, O., 1943; 110 pages.

Aircraft Powerplant Manual

G. B. Manly

Chapters: Aircraft Powerplant Types and Construction; Elements of Power Output; Valves; Fuels and Fuel Systems; Lubricants and Lubrication Systems; Carburetors, Fuel Injectors and Superchargers; Starting and Electrical Systems; Ignition Systems; Propellers; Operating the Powerplant; Servicing; the Powerplant and Trouble Sheeting Powerplant Maintenance; Detail Overhaul Procedure; Aircraft Powerplant Specifications; Mathematical and Conversion Tables.

A manual written for those who wish to acquire a knowledge of practical methods of servicing and overhauling as they are practiced on aircraft powerplants in actual use. The manual is intended for the aircraft mechanic and also to assist students preparing to take the examination required in order to obtain a commercial pilot's certificate. Information is given on detail assembly, inspection, repair, and reassembly of specific makes of engines and accessories, and on various types of propellers. Step-by-step maintenance procedures as recommended by manufacturers and found to be practical in the field are described. Frederick J. Drake & Company, Chicago, 1943; 757 pages, $4.00.

Manual of Aircraft Riveting

Marvin G. Roth

Chapters: Types of Rivets; Length and Type of Rivet; Riveted Joints; Corrosion and Heat-Treatment of Rivets; Types of Riveting; Flush Riveting; Blind Riveting; Removal of Rivets; Installation of Dzus Springs; Drill Grinding; Shop Hints on Riveting.

This pocket-size handbook deals with aircraft riveting. Modern tools, devices, and methods used in aircraft construction and repair are described. Information is given on how to meet many of the difficult problems that face the trainee or mechanic when repairing modern military aircraft. The book contains many photographs, drawings, and tables. McGraw-Hill Book Company, Inc., New York, 1943; 96 pages, $1.25.

Jane's All the World's Aircraft, 1942

Compiled and Edited by
Leonard Bridgman

Contents: Parts A and B, The World's Aeronautical Progress—Historical (Service Aviation) and Historical (Civil Aviation); Part C, All the World's Aeroplanes; Part D, All the World's Aero-Engines.

Even under the restrictions of wartime, this annual is amazing in its scope, completeness, and accuracy. Leonard Bridgman, who succeeded Charles Grey as editor, has maintained the standard set during its 32-year history of service to world aeronautics.

It is not only a history of deviation during 1942 but it is a statistical compilation of the organization of military, naval, and commercial aviation in all countries, as well as a comprehensive catalogue of all the leading aircraft and aircraft engines, the details of which it is possible to reveal.

Of particular interest is the extent of the information about the Russian, German, and Japanese air forces. J. M. Spaight contributes an introductory review of the war in the air for 1942.

Such encyclopedic reference volumes deserve the unstinted appreciation of those engaged in all phases of aeronautical development. The Macmillan Company, New York, 1943; 640 pages, $19.50.

For the next 20 seconds, the pilot's name is Elmer!

APPROXIMATELY 20 nervous seconds elapse between the time a bomber goes into its final run and the time it pulls out and heads for home.

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Elmer not only does this but, going to and from the target, he can hold the big ships in level flight and on their course with no hand on the controls.

Naturally, a device like this is not created overnight. Sperry developed the first automatic pilot before the last war. It was designed to increase safety in flight. Pioneering and development work continued. In 1933, Wiley Post flew around the world alone with the aid of a Sperry Gyropilot.

Post's epochal flight furnished spectacular proof that Elmer was practical. Sperry Gyropilots were soon standard equipment on transport planes the world over. When World War II came, still further improvements had been made to give Elmer the precision needed for bombing missions.

Improvements are still being made. When the war is over, Elmer, along with many other Sperry devices developed for peace and adapted to war, will return to the work for which he was originally designed.

With more than 30 years of development behind him, Elmer, the Sperry Gyropilot, will be well-equipped to serve tomorrow's world-wide airlines.

American bombers are now being equipped with the new Sperry Gyrotronic Pilot, a precision, electronic version of the Gyropilot.**

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Book Notes

Map Projection Studies, No. P208, by Henry M. Leppard and L. Philip Denoyer; Denoyer-Geppert Company, Chicago, 1943; 20 pages.

A collection of selected map projections with explanatory text presents the fundamental concepts of map projections that are basic both to map making and to map reading.

What You Should Know About the Navy, by Hanson W. Baldwin; W. W. Norton & Company, Inc., New York, 1943; 260 pages, $2.50.

Any book about the Navy by Hanson W. Baldwin is certain to be authoritative. He has written a readable description of the American Navy which will give civilians the information they need to know how naval units operate.

In the chapter on "The Fighting Planes" the types used from ships and shore are described clearly, and the uses to which they are put are outlined.

This is a 1943 revised edition of the book originally published in 1941 and revised in 1942 under the title *What the Citizen Should Know About the Navy.*

Famous Planes and Famous Flights, by John Winslow; The Platt & Munk Company, Inc., New York, 1943; 48 pages.

Well illustrated with colored pictures, this book reviews the history of flight from the Wright Brothers' first flight at Kitty Hawk to present-day warplanes. The best-known airplanes are pictured and historic flights are detailed.

It is intended primarily for children but will be of interest to all who wish to have a compact panorama of flight as it has developed in the past forty years.

Aviation Medicine, by Louis Hopewell Bauer; Oxford University Press, New York, 1943; 50 pages, $1.50.

This book is reprinted from *Oxford Loose-Leaf Medicine* and gives in condensed form the status of aviation medicine as seen by flight surgeons at this time. The field is expanding so rapidly and so many new phases of physiology and psychology are being introduced that this summary by an authority will be most useful.

It will acquaint the flight surgeon, as well as the general practitioner, with the scope of aviation medicine and the more recent developments.

Special consideration is given to the care of the flier, the limitations of his flying time, and the latest treatment for air sickness. An excellent bibliography is included.

Destination Tokyo, by Steve Fisher; D. Appleton-Century Company, Inc., New York, 1943; 226 pages, $2.50.

A novel written around the experiences of a submarine operating in the Pacific Ocean. It describes life aboard a "pig boat," as well as the romantic incidents when sailors are on leave. The climax of the story is the bombing of Tokyo and its destruction, together with a similar fate for Yokohama, Kobe, and Nagoya.

Bridge to Victory, by Howard Handleman; Random House, New York, 1943; 275 pages, $2.00.

The reconquest of the Aleutians and the opening of the shortest road to Tokyo is the story of military, naval, and air operations that presented difficulties unique in the annals of this war. The weather is a continued hazard for the "Zoomies," as the pilots are known in the North. The mud and other surface conditions were difficulties that the engineers had to meet with untiring effort. The capture of Attu forced the abandonment of Kiska and opened the air to Paramushiro, the Japanese naval base in the Kuriles.

The determination of the sons of the Emperor to die rather than surrender was exemplified perhaps more completely during these operations than elsewhere. The heroism of the American soldier who was engaged in his first contact with such warfare is shown time and again.

The book is well documented by names and eyewitness accounts. The operations of our air forces under the worst possible conditions are described by a correspondent who participated in many flights.

Air Force, by John O. Watson; Grosset & Dunlap, New York, 1943; 241 pages, $0.50.

This is a novelized version of the motion picture *Air Force.* It follows, as the picture did, the adventure of the B-17 Flying Fortress "Mary Ann" from San Francisco to its arrival on fateful December 7, 1941, at Hawaii, on to Wake Island, and the Philippines, and its combat experiences in the South Pacific.

It is as thrilling a story as it is in the picture and gives a glimpse of the life on a bombing plane which encountered many exciting adventures during almost continuous combat.

Escape from Java, by Cornelius van der Grift and E. H. Lansing; Thomas Y. Crowell Company, New York, 1943; 166 pages, $2.00.

A Dutchman who had lived in Batavia, Java, for many years gives an eyewitness account of the capture of the island by the Japanese and the story of his escape with two companions in a small sailing boat. They eluded the sentries and the watching fleet and made their way 3,000 miles across the Indian Ocean. Fortunately, they were picked up by a British cruiser toward the end of their trip and are now in training to be with the Allied invaders when Java is recaptured.

The Navy at War, by Lt. Comdr. Griffith Baily Coale, Lt. Dwight C. Shepler, Lt. (j.g.) Mitchell Jamieson, Lt. William F. Draper, Lt. Albert K. Murray; William Morrow and Company, New York, 1943; 160 pages, $4.00.

The authorities in this war have made sure that its pictorial history will be more than a collection of photographs. Artists have been with the fleets and military forces and have drawn and painted what they saw. During night engagements and when the weather has been unfavorable for photographs, the artist on the spot put his impression on paper. These, with fair weather drawings, have preserved a record that will be invaluable after the war.

This book is the result of the work of five artists who were on all fronts painting pictures of our Navy in action. They are reproduced, many in color, with a commentary by Hanson W. Baldwin. More than a hundred pictures are included which show almost every phase of naval life and action. Both text and pictures give a view of naval warfare which will increase the traditional admiration for the heroic daring of our naval officers and crews.

Girls at Work in Aviation, by Dickey Meyer; Doubleday, Doran & Company, Inc., Garden City, N.Y., 1943; 209 pages, $2.50.

As over a million women are engaged in aviation in this country, such a vocational book as this is timely, since it will assist many girls to find what part they are capable of taking in the world of flying.

It tells the work of the girl pilots of the WAFS and the remarkably efficient service they are rendering as ferry pilots. It emphasizes the fact that women have always been instructors and as teachers of student pilots they have been most successful. As Link trainer operators, map makers, and radio specialists they are rendering invaluable service to the training program and in the operation departments of air lines.

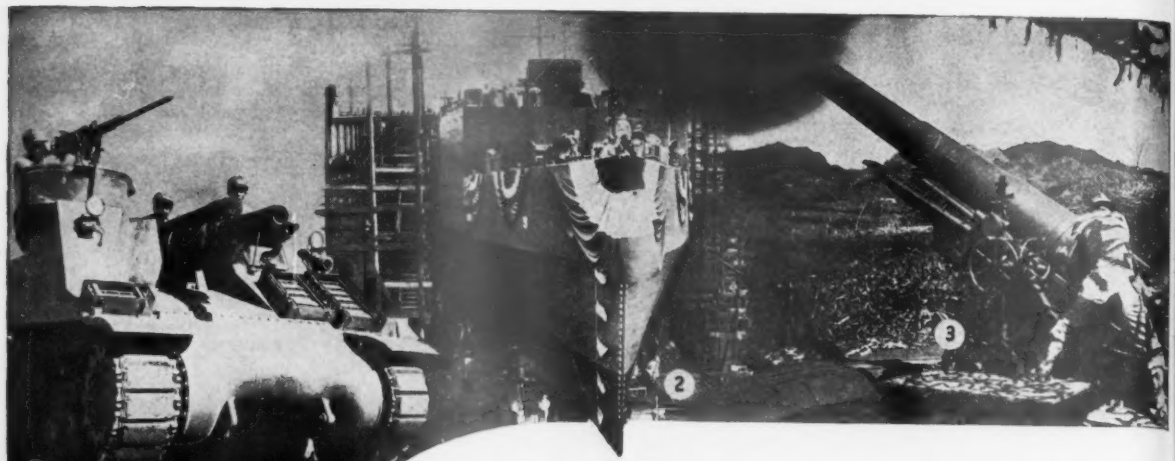
As nurses, aircraftswomen, and engineers the place of women in the aircraft field is becoming secure and the future holds great promise for further vocational developments.

Uncle Sam's Army, by George Avison; The Macmillan Company, New York, 1943; 40 pages, $1.00.

This book is intended to inform boys and girls of the work of the many types of soldiers that comprise the Army of the United States. It will interest older readers as well, since it is excellently illustrated, and will let them become familiar with the various insignia worn by soldiers.

Glossary of Flying; Temple Press Ltd., Bowling Green Lane, London, 1943; 128 pages, 1*s.* 6*d.*

This handy booklet on aeronautical nomenclature which is reprinted from *The Aeroplane Spotter* will be useful not only because of its contents but because of its pocket size. It does not attempt to include all the technical terms used by aeronautical engineers but rather to give those who are not familiar with aeronautics a reference to the more widely used words that will be encountered in reading and discussing aviation.



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It's a Piece of Cake or R.A.F. Slang Made Easy, by Squadron Leader C. H. Ward-Jackson; The Sylvan Press, London, 1943; 64 pages, 2*s*.

Out of the camps of the R.A.F. and the American Air Forces has come slang which must be understood so that airmen's conversation may be followed with any degree of comprehension. This booklet is not only a compilation of the current slang to be heard in R.A.F. camps, but is an indication of the sense of humor that airmen have put into words. Such a nomenclature will be particularly useful to our soldiers who associate with the men of the R.A.F.

Dave Dawson with the Flying Tigers, by R. Sidney Bowen; The Saalfield Publishing Company, New York, 1943; 250 pages, $0.60.

Another of the Dave Dawson series brings him into the service of the Flying Tigers in China. Dave is only 17 but has had almost as much experience through these books as the oldest pilot in service. These books for boys are not only inspirational, but they bring youth close to the battle fronts and prepare them for service they may face in the future.

Tommy Visits an Aircraft Factory, by Lewis Theiss; W. A. Wilde Company, Boston, 1943; 146 pages, $1.50.

Tommy is taken through an aircraft factory by a pilot he has rescued after a crash. The pilot describes the construction of an airplane and many of its parts. He discusses with the engineers of the factory some of the problems of flight and plane manufacture. Finally, the pilot takes the boy for a flight. The book will give any boy a better understanding of the complex construction of an airplane.

Flying to Victory, by A. F. Casselberry; Cupples & Leon Company, New York, 1943; 246 pages, $1.00.

This book is dedicated to the boys who are building models and studying aviation in preparation for military service when they are older. It is the story of three boys who develop a plane locator and engage in perfecting a radio-controlled airplane. The story emphasizes the technical rather than the piloting skill of the boys and as such will have an inspirational effect on its youthful readers.

Warfare in the Air, by Sydney E. Veale; The Pilot Press, London, 1943; 48 pages, 5*s*.

The 1942–1943 edition of this book carries the record of the Royal Air Force from the beginning of the war to the Battle of Egypt. It contains many photographs of the latest types of aircraft in service on the war fronts.

The dominant role of air power is stressed with particular attention given to night combat. The concluding chapter treats of aircraft production. An excellent chronology for 1941 and 1942 is added.

A Medical Program for Aviation, by Ross A. McFarland; Harvard Business Review, Cambridge, Mass., 1943; 127 pages.

This reprint from the *Harvard Business Review* covers a broader field than the title indicates. It outlines a medical program that is applicable to any industrial company, using the experience gained in the aircraft industry as a guide. Essentially, such a program stresses the preventive side of medical treatment and outlines the organization required to put such a plan into operation.

Pilots of Fighter Command, by Capt. Cuthbert Orde; George G. Harrap & Company Ltd., London, 1943; 64 pages, 25*s*.

The author has drawn 64 portraits of fighter pilots and has added a personalized sketch of their outstanding characteristics. Practically all have decorations indicating the especially meritorious service they have rendered in combat operations. The portraits are informal and give a composite impression of the R.A.F. pilot.

The Marines in Review, by Norman V. Carlisle; E. P. Dutton & Company, Inc., New York, 1943; 192 pages, $2.50.

Although this book is intended to describe all of the activities of the U.S. Marine Corps, it has special chapters on the Marine air force and the paramarines. When the reader has read this review of the history and successful record of the Marines he will have a still higher regard for the sacrifices and heroism of these leaders in so many combat fields.

A Ship to Remember, by Alexander T. Griffin; Howell, Soskin, Publishers, Inc., New York, 1943; 288 pages, $2.50.

The story of the aircraft carrier "Hornet" will always live in the annals of the U.S. Navy. Its career as well as its end have added traditions to the Navy record. After its spectacular voyage carrying the Doolittle raiders for their take-off for Tokyo, it was ordered to the South Pacific Seas where it was finally bombed.

This narrative of the personnel who operated the carrier and the many incidents that make life on this type of ship interesting are given by a writer who has not only had access to the records, but the cooperation of many of the officers who had a part in the saga of the "Hornet."

Science from Shipboard; Science Service, Washington, D.C., 1943; 268 pages.

This manual of information and instruction for sailors was prepared by a group of scientific writers and is principally concerned with navigation and related subjects such as weather, astronomy, time, sea life, and birds, all of which may be used by sailors in their course finding. Useful information about his ship and himself has been prepared by experts. The book will afford a relief from any monotony on shipboard by giving helpful information about what lies beyond the rail.

Last Flight from Singapore, by Arthur G. Donahue; The Macmillan Company, New York, 1943; 169 pages, $2.50.

The author was an American barnstorming pilot from Minnesota who joined the R.A.F. in 1940 and was the first American pilot to see combat with the English. He was one of the handful of fighter pilots who fought the Battle of Britain. In 1941 he was ordered to Singapore, and his narrative is of his experiences during the last few days of air fighting over that doomed city. He was forced to fly to Palembang, was driven from there to Bandoeng, Java, and from there returned to England by way of India. In 1943 he was killed in combat.

The manuscript of this book was found among his effects, and with the photographs he took makes one of the most thrilling stories of air fighting in the Far East which has been written. He writes as an American would, and as a reward for the heroic and heartbreaking defense of ill-defended cities he deserved the Distinguished Flying Cross, which he received.

Commando of the Clouds, by Stewart M. Emery; Cupples & Leon Company, New York, 1943; 245 pages, $1.00.

An exciting story of an American pilot whose daring exploits as a spy take him into many critical situations. He locates a cave on the chalk cliffs of southern England which contains 8,000 German troops, hidden airplane catapult rooms, and submarine chambers. He escapes and the British destroy the base from which an invasion of England was to be made.

He also makes a lone raid on German Headquarters in France to secure maps of antiaircraft gun emplacements. These and other escapes bring him high commendation from both the British and American commands.

Young America's Aviation Annual 1944, by David C. Cooke; Robert M. McBride & Company, New York, 1943; 224 pages, $2.50.

The fourth edition of this annual reflects the astonishing growth of aviation under the stimulus of war. It gives the younger generation a pictorial and textual panorama of military, naval, commercial, and industrial aviation, written in a style that they can understand and enjoy.

A chapter on the fundamentals of air fighting will stimulate interest on the part of boys who see in the future this kind of work for them to do. As the only yearbook for youthful readers, it has come to occupy a place of its own on the aeronautical book shelf.

What is Flying? by Joseph Lawrence; Frederick Warne & Company, Ltd., London, 1943; 112 pages, 2*s*. 6*d*.

A booklet containing a simplified account of the theory and practice of flight. Sections discuss how birds fly

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the atmosphere, why and how airplanes fly, the science behind flying, the power for flying, the flying of airplanes, and eight typical airplane types.

Approach to Aircraft Recognition, by J. G. M. Miller and D. M. Harris; Argus Press Ltd., London, 1943; 38 pages, 9*d*.

Silhouettes and recognition features of the 64 types of airplanes listed for the National Association of Spotters' Clubs tests are given. The booklet is intended to help those who are teaching themselves to distinguish one airplane from another.

German Military Science, compiled by Ames Johnston; The Macmillan Company, New York, 1943; 146 pages, $2.00.

A book of readings contains selections from military books currently read by officers of the German Army. They are offered as suitable for American college students who have had three semesters of German, if they are familiar with the subject matter. A vocabulary is furnished at the back of the book.

Refueling the Airplane; Airlines War Training Institute, Washington, D.C., 1943; 31 pages.

A booklet for air-line service crews contains information on aircraft refueling procedures and the care of refueling equipment. Notes on fire prevention and fire fighting also are furnished. A considerable portion of the publication is devoted to refueling from the truck or tank system.

Scale Model Aircraft, by V. J. G. Woodason; Useful Publications, London, 1943; 110 pages.

A book is offered as a practical text on the building of scale-model aircraft. The construction of scale models is described and their uses are outlined. The author also gives advice on the materials and tools to use, the types of model aircraft to build, and the photographing of models.

Magnesium, A Magic Mineral, by Lilian Holmes Strack; Harper & Brothers, New York, 1943; 54 pages, $1.00.

The story of magnesium, its industrial development and uses, has been written for young readers. It traces the history of the metal from its discovery and early uses to the modern methods of processing it from sea water and extracting it from ore. The employment of magnesium in aircraft construction is mentioned and illustrated.

Lighting Handbook; Westinghouse Lamp Division, Westinghouse Electric & Manufacturing Company, Bloomfield, N.J., 1943; 175 pages.

A practical guide and working reference book for lighting engineers, designers, and builders. One chapter is devoted to aviation lighting. This contains information on airport lighting and seadrome lighting. A table of reference data on equipment for airport lighting is included.

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Rabl Star Finder, by S. S. Rabl; Cornell Maritime Press, New York, 1943; 2 pages, $1.50.

A star finder takes the form of a folder containing two charts with concentric discs. One is a star almanac, consisting of a revolving disc which gives the positions of the stars at the meridian of the operator's local civil time or zone time. The other is a star graph, consisting of a stationary base graph and a transparent rotating graph. This chart is used to determine the position of a star and to identify an unknown star.

Mill and Factory Book of Tool Care, by Carl C. Harrington; Duell, Sloan and Pearce, New York, 1943; 233 pages, $1.00.

A collection of tool craftsmanship charts depicting some of the common tool and equipment abuses and their proper correction. It constitutes one of the series of "Essential Books."

The Story of West Point, by R. Ernest Dupuy; The Infantry Journal, Washington, D.C., 1943; 282 pages, $0.25.

Weapons for the Future, by Melvin M. Johnson, Jr., and Charles T. Haven; The Infantry Journal, Washington, D.C., 1943; 152 pages, $0.25.

These books represent additions to the "Fighting Forces Series." The one titled *The Story of West Point* first appeared under the title of *The West Point Tradition in America*. This book is neither a history of the Military Academy nor is it a eulogy on the profession of arms as such. It is, rather, a presentation of the development of a system of education in a national institution, and of its impact upon the United States.

The second book titled *Weapons for the Future* discusses arms development for a modern army. It was first published under the title *For Permanent Victory*.

Airplanes and How They Fly, by Marshall McGlintock; Frederick A. Stokes Company, New York, 1943; 94 pages, $2.00.

An introduction to aviation for young readers. The book explains how and why a plane flies and the way to control it. Drawings and diagrams accompany the text. There are also chapters on the history of how man learned to fly, the parts of a plane, the instrument board, planes of today, and planes of the future.

Symposium on Powder Metallurgy; American Society for Testing Materials, Philadelphia, 1943; 55 pages.

The booklet contains reprints of seven papers read at the 1943 spring meeting of the American Society for Testing Materials. The papers read were as follows: The Fundamentals Necessary to Apply Powder, Charles Hardy; The Effect of Pressure on the Properties of Compacts, Clarence W. Blake; The Influence of Homogenization upon the Physical Properties of Copper Nickel Powder Alloys, Frederick N. Rhines and Russel A. Meussner; The Effect of Particle Size on the Shrinkage of Metal Compacts, P. R. Kalischer; Alloy Powders, T. H. Lashar; Metal Powder Friction Materials, J. F. Kuznick; The Hot Pressing of Metal Powders, W. N. Pratt.

The discussions following the reading of the papers are also presented.

Materials Handling, by Harry E. Stocker; Prentice-Hall, Inc., New York, 1943; 309 pages, $5.00.

The many phases of transportation connected with the flow of materials in the plant are dealt with in this book. Problems of receiving and unloading, processing, assembly, storing, and shipping are discussed, and the author explains how these activities should be coordinated to insure speed and economy in meeting production schedules. Case histories of leading organizations are given to illustrate how they solve their mechanical handling problems. These cover manufacturers of equipment ranging from delicate precision instruments to the heaviest machinery now being built.

Toward New Frontiers of Our Global World, by N. L. Engelhardt, Jr.; Noble and Noble, Publishers, Inc., New York, 1943; 140 pages, $1.50.

A text in global geography which has been prepared to point out to growing boys and girls some of the developments that may be expected in the postwar period. The author sets forth how modern methods of transportation and communication are shrinking the world. The book contains recent statistics on the subject and nearly 100 modern maps and illustrations.

How to Identify Aircraft, by Squadron Leader G. E. Wilson; Wm. Collins Sons & Company Canada Ltd., Toronto, 1943; 147 pages, $1.75.

The second edition of a text on aircraft identification. The subject is simplified by the provision of 700 drawings which emphasize in proportion and shading the characteristics of the most important types of aircraft in the syllabus of training in the Royal Canadian Air Force. Each type of plane is described and illustrated. There are also 52 photographs of planes in action.

Pipe and Tube Bending Handbook; Copper & Brass Research Association, New York, 1943; 80 pages.

Practical methods for bending pipe and tubes of copper, brass, and related alloys are described, and information is given on typical tube-bending operations and equipment. Definitions applicable to brass mill products are also given. There are a number of tables containing data on pipe and tubing.

Library Accessories

Combustion-Chamber Design for Oil-Engines, by Paul Belyavin; The Sherwood Press, Cleveland, 1937; 78 pages, $1.50.

A study of the fundamental principles and problems of designing combustion chambers for oil engines, supplemented by historical notes on the developments of this type of design.

A Handbook for Auxiliary Police, Office of Civilian Defense, U.S. Government Printing Office; Washington, D.C , 1942; 58 pages, $0.10.

One of a series of civilian defense handbooks, this booklet deals with the duties of auxiliary policemen.

A Handbook for Messengers, Office of Civilian Defense, U.S. Government Printing Office, Washington, D.C., 1942; 55 pages, $0.10.

A revision of the original handbook for messengers, prepared with the collaboration of the Boy Scouts of America. In addition to instructing enrolled civilian defense messengers in their duties, the manual also describes general measures for safeguarding civilians against the effects of air attack.

A Handbook for Rescue Squads, Office of Civilian Defense, U.S. Government Printing Office, Washington, D.C., 1942; 82 pages, $0.15.

The training, organization, and duties of groups assigned to rescue air-bombardment victims are covered in this one of the civilian defense manuals.

War Comes to the Docks, by Ben T. Tinton; Marshall, Morgan & Scott, Ltd., London, 1941; 124 pages, 2*s*.

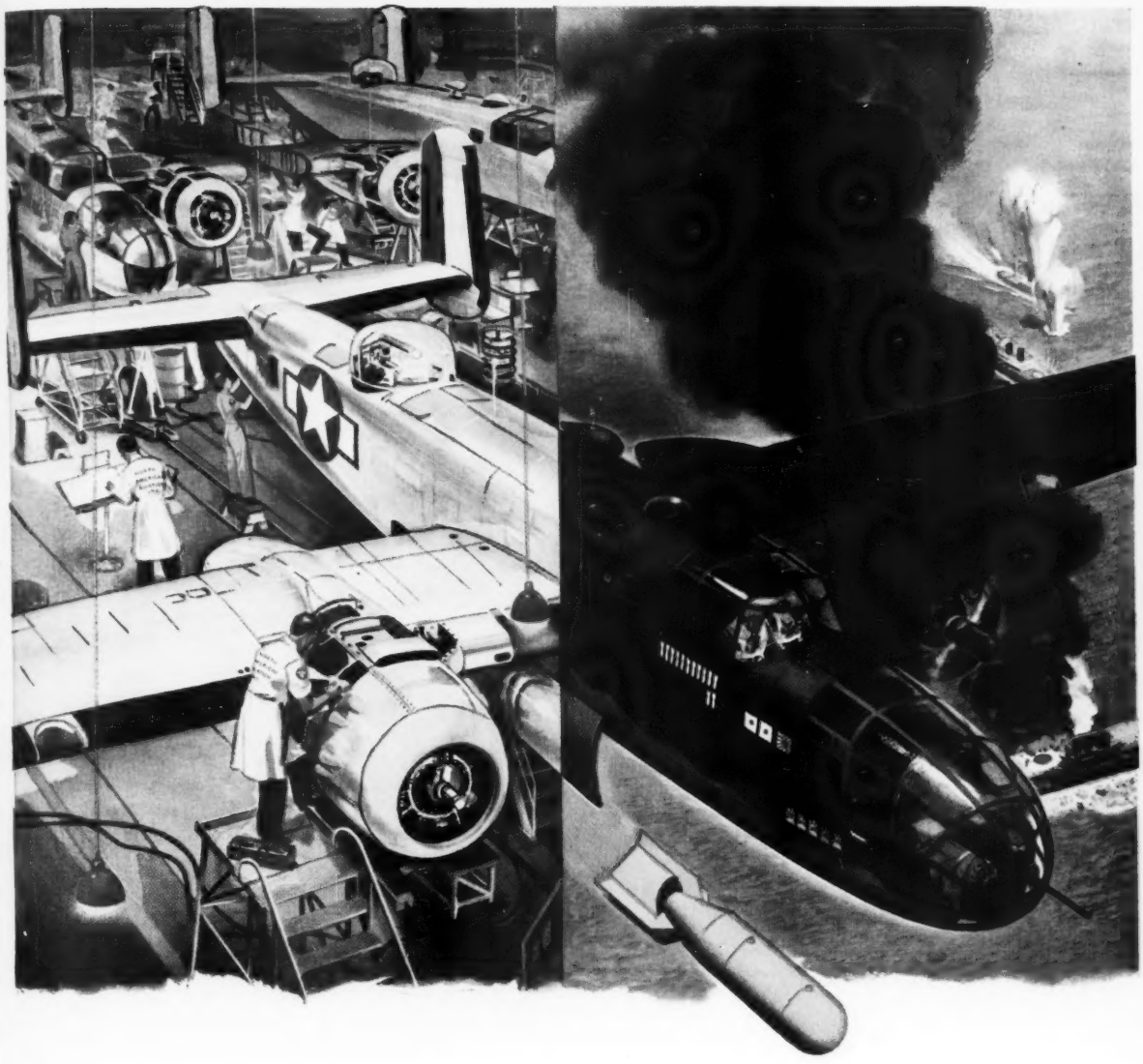
The story of how the people of England's dock areas withstood the blitzkrieg is interwoven with a record of the origin, growth, and activities of the Dock and Settlements.

New Ways of War, by Tom Wintringham; Penguin Books, Inc., New York, 1942; 128 pages, $0.25.

The second edition of a book analyzing the tactics, strategies, and defense methods of modern land warfare was written to include consideration of the improvements that have taken place in military through, and practice since, the early days of World War II.

Suez to Singapore, by Cecil Brown; Random House, New York, 1942; 545 pages, $3.50.

A war correspondent's personalized account of the war in the Pacific. "On-the-spot" reports include experiences in the Egyptian Desert, Syria, Malaya, Dutch East Indies, and Australia.



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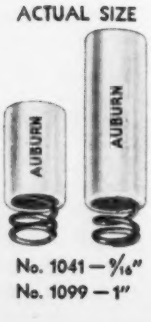

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Elements of Photogrammetry, by George D. Whitmore; International Textbook Company, Scranton, Pa., 1941; 136 pages, $1.75.

A study of the fundamentals of obtaining surveys by means of photographs.

Heat Engines, by A. C. Walshaw; Longmans, Green and Co., New York, 1938; 413 pages, $2.75.

An introductory textbook for students preparing for initial examinations on the subject of heat engines and applied thermodynamics.

Study Guide and Reference Material for Commercial Radio Operator Examinations, Federal Communications Commission; U.S. Government Printing Office, Washington, D.C., 1939; 95 pages, $0.15.

A Government-issued pamphlet, designed to familiarize prospective examinees with the scope of the questions contained in the various elements of the commercial radio operators' license examinations.

Air Raid Protection Code for Federal Buildings and Their Contents, prepared by the Interdepartmental Advisory Committee on Protection, Federal Works Agency; U.S. Government Printing Office, Washington, D.C., 1942; 173 pages, $0.20.

Prepared for the purpose of assisting the Public Building Administration in the execution of a nation-wide program of protection for Federal buildings, this book gives building managers and owners a suggested step-by-step treatment of their air-raid protection problems.

Digest of Civil Air Regulations for Pilots, Civil Aeronautics Bulletin No. 22, 6th Edition, August, 1942; U.S. Government Printing Office, Washington, D.C., 1942; 74 pages, $0.20.

A compilation of those provisions of the Civil Air Regulations which most directly affect the pilot, based on the regulations in effect on August 15, 1942. Designed as a textbook or a supplement for anyone studying for a C.A.A. pilot's certificate.

Wood Handbook, prepared by Forest Products Laboratory, U.S. Department of Agriculture; U.S. Government Printing Office, Washington, D.C., 1940; 326 pages, $0.35.

This manual presents basic information on wood as a material of construction with data for its use in design and specifications.

Air Raid Shelters in Buildings, Office of Civilian Defense; U.S. Government Printing Office, Washington, D.C., 1942; 42 pages, $0.15.

General planning policies for protective construction are considered in this pamphlet. For illustration, representative problems are discussed.

Defense Against Chemical Attack, War Department Field Manual 21-40; U.S. Government Printing Office, Washington, D.C., 1942; 282 pages, $0.35.

Supersedes Basic Field Manual 21-40, May 1, 1940, on methods of protection against the employment of chemical agents in warfare.

British Aeroplanes Illustrated, by C. A. Sims; A. & C. Black Ltd., London, 1934; 95 pages, $1.25.

Principal types of British airplanes in service are described and illustrated. Both military and civil types are included.

(*Continued from page 13*)

suming that such compartments will be loaded with packages, each measuring 12 by 12 by 12 in., and that one small tie-down fitting will be provided per such package judiciously spaced, it follows in the interest of consistency that the ultimate strength of such auxiliary tie-down fittings should be 200 lbs. normal to attachment wall and 100 lbs. parallel to the attachment wall.

It would apparently be incorrect to assume that an auxiliary floor should be designed to only 40 lbs. per sq.ft. The auxiliary floor loading should be determined by consideration of the usable space above the floor, ease of getting to that space, location of the compartment in the airplane, load limitations governed by permissible c.g. range of the airplane, etc. The strength of auxiliary floors is therefore a matter of decision between the manufacturer and procuring agency.

Proposed Design Criteria

Main Floor—Static strength, 200 lbs. per sq.ft.; floor to be nonskid; tie-down fittings to be recessed flush with surface.

Auxiliary Floor—As determined by Procuring Agency.

Main Tie-Down Fittings—Ultimate strength, 1,000 lbs. normal to attaching surface plus 500 lbs. parallel to attaching surface. Uniform spacing on the main floor and one row on each side wall, at 22 in. ± 3 in. between centers. Wherever an engine-cradle tie-down fitting or litter attachment fitting (irregularly spaced) is less than half the uniform spacing distance from a main tie-down fitting center, then that main tie-down fitting may be omitted.

Doors

Main Cargo Door

In reference to the size of the main cargo door, it appears that it should be large enough to permit full utilization of the cargo space available, assuming that some packages will nearly equal the height and width of the main cargo cabin. For instance, if the cabin is large enough to contain a small truck, then the door should be of such size and location as will permit loading this small truck as a whole piece (not requiring dismantling) without any restrictions and with a minimum amount of accessory equipment.

Auxiliary Doors

The auxiliary door is usually considered adequate if it permits easy entrance and egress into the cabin for personnel, but, if it is to be utilized for parachute jumping, then its size should be 30 to 36 in. wide by 60 to 72 in. high, the bottom flush with the floor, with no ledges to stumble over and no protuberances to catch in clothing or parachute shroud lines. It should be located to provide maximum clearance of the tail surfaces for the jumpers—one door on each side of the fuselage. Doors should be capable of being opened inward in flight.

Auxiliary Aerial Delivery Doors

Until experience indicates the proper size, it is believed that auxiliary aerial delivery doors should be large enough to drop the 1/4-ton truck (jeep) through with proper clearances. Its location should be such as to cause a minimum effect on the c.g. of the airplane when "drop loads" are released.

Emergency Exit Doors

The emergency exit doors should be provided for exit in the air and therefore should be large enough to permit unobstructed passage of personnel wearing parachutes. The ratio of number of emergency exits to number of personnel carried according to the C.A.A. should preferably be not less than 1 to 8. Exits in this case mean all apertures of size large enough to get through while wearing a parachute. For instance, a large cargo door might possibly be considered equivalent to two or three emergency exits. In some cases, emergency exit doors may be judiciously located to serve the dual purpose of also being utilized as maintenance exit doors (to get out on the wings, stabilizers, etc.).

Other Egress Considerations

Other egress considerations involve crash-landing conditions. If doors located in the belly (or even upper doors likely to jam closed on the crash landing) are impossible to open, then a knockout panel should be provided or the most suitable wall area should be indicated by red paint stripe and an axe located adjacent thereto. Exits located from a point of view of crash-landing considerations should also be considered in connection with "ditching" operations.

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Supplementary to the lists published in June, September, October, and November, 1943, issues of the Aeronautical Engineering Review

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The translations have been reproduced from typewritten copy and the number of pages in each is indicated at the end of each reference. Bibliographic information has been taken directly from the translations. Photostatic copies are also available at the usual library rates.

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(*Continued from page 109*)

cal sighting data are transmitted from the sound locator to the searchlight.

Various domestic and foreign translator instruments that operate on either direct or alternating current are explained and their efficiency is compared. Auxiliary devices, such as junction box, plug, and lines, are briefly covered. *Zeitschrift des Vereines Deutscher Ingenieure*, July 24, 1943, pages 449–455, 28 illus.

R.N.A.F. in Iceland. An article on the activities of the Royal Norwegian Air Force squadron stationed in Iceland. Supplementary to a description of some of the operational and maintenance problems that the Norwegians encountered under Icelandic conditions is the announcement that they have now been transferred to Great Britain and will be re-equipped with Sunderland flying boats to replace the Northrop seaplanes and Catalina flying boats which they had been using. The article also mentions the fact that the Norwegian training camp is no longer at Toronto, Canada, but has been moved to Ontario. *Flight*, October 7, 1943, pages 388–390, 5 illus.

Welding

Applications of Flash Welding in Aircraft Production. Robert Milmoe. How flash welding is being applied to the construction of aircraft. Information is given on the advantages of the flash-welded joint over the fusion-welded joint. The writer discusses types of applications, design considerations, tolerances and location, special features of the flash-welding machine, machine settings, and inspection methods. *Automotive and Aviation Industries*, November 15, 1943, pages 30–32, 88, 90, 6 illus.

Tips on Welding. C. H. Jennings. The causes and methods of correction for 14 common types of welding troubles are discussed. Brief paragraphs are devoted individually to distortion, warping thin plates, welding stresses, spatter, undercut, cracked welds, poor surface appearance, poor fusion, incomplete penetration, porous welds, brittle joints, corrosion, irregular weld quality, and magnetic arc blow. *Air Pilot and Technician*, October, 1943, pages 30–33, 16 illus.

Miscellaneous

Speak Up, Lad. Lt. Ken Lester. How to conduct vocal communication in such a way as to overcome the noises of an airplane in flight is covered in a discussion of the best methods of speaking and using the communication equipment of the plane. The three components of speech are listed as articulation, phonation, and rate, each of which is defined and exemplified. With particular reference to communications between instructor and student while in flight, the article gives advice on the selection of words, pronunciation, rate, volume, and the use of the plane's intercommunication equipment. *Air Facts*, December, 1943, pages 14–18, 1 illus.

Aircraft Interior Decorating Analyzed. E. J. Foley. In this article the writer discusses present aircraft interior decorating designs and outlines possible future interior layouts. He studies the grouping of seats, discusses interior colors, and defines the super-luxury aircraft of the future. *American Aviation*, November 15, 1943, page 80, 1 illus.

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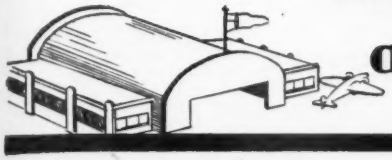


Training Crews for Bombers

"Human Modification Center" Teaches Navy Personnel to Care for Mariners. A description of how a bottleneck in the training of maintenance men and combat crews for the servicing and operation of Mariner patrol bombers was broken by the establishment of a unique "human modification center" at the Banana River base of Transition Training Squadron Atlantic. It is explained that the secret of the Banana River modification line lies in its "fixtures." These are five in number—representing the PBM fuel, bombing turret, electrical, and radio systems. While embodying all essential details, these "fixtures" or trainers are set up so that the intricacies of the various systems practically explain themselves. *The Martin Star*, December 7, 1943.

Aircraft Development

Wings for the Navy. An illustrated booklet contains a history of Chance Vought Aircraft and it products, with notes on the founder. The development of the various types of Vought aircraft, first at Long Island City, and later at East Hartford and Stratford, is outlined. The origin of the Corsair and the evolution of other Vought airplanes are chronicled, and records established by these planes are reviewed. Illustrations show various Vought models in service. *Chance Vought Aircraft Division, United Aircraft Corporation.*

Electronic Drive

The Thy-mo-trol electronic drive for providing and controlling adjustable-voltage power from a.c. lines, thus making possible the utilization of the inherent advantages of d.c. motors, is described in a 40-page bulletin, GEA 4025.

This bulletin is divided into two parts. The first part explains the drive in considerable detail, describes its functions, and lists its advantages. This section also lists applications of the drive and describes some of them. Typical applications include installations on grinders, turret lathes, drill presses, conveyers, form-and-thread milling machines, and machines for testing tachometers, magnetos, propeller governors, and the tensile strength of various materials.

The second part of the publication is devoted to a technical explanation of the operation of the drive. *General Electric Company.*

Properties of Metals

A booklet titled *Properties of Some Metals and Alloys* contains information on the chemical composition, mechanical properties, hardness, and physical constants of metals. The *International Nickel Company, Inc.*

Alignment in Aircraft

Alignment Lengthens Aircraft Lifelines. How the use of alignment instruments reduces the amount of time required to repair and service airplanes is described. It is noted that the importance of alignment has long been recognized in the automotive field and that alignment is even more important in aircraft, not only for wheels and frame but for the propeller, fixed and movable surfaces, and guns. The use of the Aeraligner, an instrument designed for checking the alignment of aircraft parts and structures, is illustrated. *Service Engineering*, Fall, 1943.

Instrument Publications

Revised publications on Pioneer aircraft instruments have been issued. They include installation and line maintenance manuals on the Autosyn position transmitter; overhaul and test procedure manuals on the Autosyn fuel flowmeter transmitters; an overhaul manual on rate-of-climb indicators; and service bulletins on tamperproof seals for phasing control adjustment of amplifiers; the elimination of the toggle switch in the Gyro Flux Gate Compass amplifier; and the modification of demand oxygen regulators to permit operation on maximum supply pressures of 1,800 lbs. per sq.in. A complete list of Pioneer Instruments publications also has been issued for November-December, 1943. *Eclipse-Pioneer Division, Bendix Aviation Corporation.*

AN Catalogue Sections

Five supplementary pages have been compiled to provide up-to-date information and data on Cannon Type AN connectors and accessory fittings, such as cable clamps, dust caps, etc. Not only are new AN inserts listed together with tabular data but also new tooling on existing inserts and changes in numbering where dash numbers have been assigned. In several instances, new tooling dates are given. Also, corrections and tentative dash numbers and service are noted.

For convenience, users of the Type AN Bulletin may transfer many of the changes and new items to the original pages, if desired. *Cannon Electric Development Company*, Los Angeles.

Artificial Daylight for Bomber Plant

Blacked Out but Daylighted. An article telling about the windowless Bell bomber plant at Marietta. Workers are unable to see the sun, but they carry out their duties under light that is the equivalent of daylight. It is explained that the artificial light installation, consisting of 36,000 200-watt, two-tube fluorescent fixtures, each 6 ft. long and mounted end to end, aggregates 58 miles in length. The article tells how the system was designed and is being operated and maintained. *The Bellringer*, December, 1943.

Troop Carrier Command

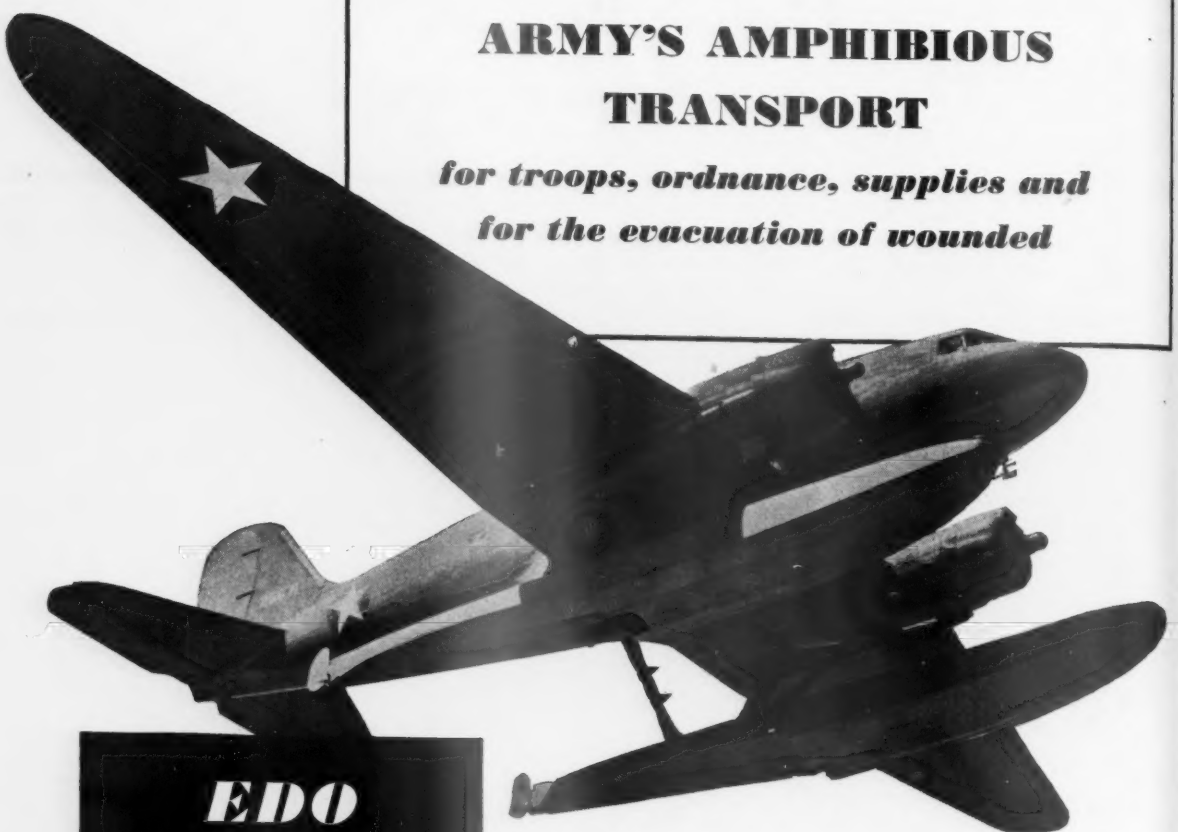
The "Biscuit Bombers." An article on the Troop Carrier Command of the U.S. Army Air Forces. The story of how the Command was established in 1943 is related briefly and its activities are outlined. Several short accounts of varied exploits illustrate the performance record of the T.C.C. in different campaigns. Information is included on the aircraft used by the Command, the qualifications of its airplane and glider pilots, and its training centers. The described functions of this Air Forces organization given chief importance are the transport of air-borne troops into enemy territory, the hauling of equipment and supplies in combat areas, and the evacuation of the wounded from battle zones. *Douglas Airview*, November, 1943.

History of an Aviation Company

Yesterday's "Touch of Tomorrow." Richard H. Depew, Jr. Part II of a continued article on the history and development of the Fairchild Engine and Airplane Corporation and its products. Written by a man who played a major part in its development, the second installment is concerned with the building of the first Fairchild plane—the FC-1. The story of how the plane was actually designed and manufactured is related in great detail. The test-flying of the plane, the attainment of what is recorded as the fastest average speed for any OX-powered airplane entered in the Second Airplane Reliability Tour for the Edsel Ford Trophy, and the participation in the National Air Races at the Philadelphia Sesqui-Centennial Exposition are noted.

ARMY'S AMPHIBIOUS TRANSPORT

for troops, ordnance, supplies and for the evacuation of wounded



EDO AMPHIBIOUS FLOATS

with retractable wheels

built for the needs of AIR-SEA-LAND WARFARE

An Edo achievement—Developed by Edo engineers, these giant twin floats, equipped with retractable wheels for operation from beaches and landing fields, represent a notable war-time advance in the design of seaplane float gear.

EDO AIRCRAFT CORPORATION, 413 SECOND STREET, COLLEGE POINT, L. I., N. Y.

Photographs show the Douglas C-47 "Skytrain" on Edo Model 78 Amphibious Float Gear.

★ EDO FLOAT GEAR ★

SERVES THE UNITED NATIONS

The article also contains data on the Caminez engine, which contributed to Fairchild's experience in building engines. Besides Depew and Sherman Fairchild, aviation personalities who are mentioned in connection with Fairchild development include Norman MacQueen, Fred Weymouth, Alexander Klemin, Robert Simon, "Rudy" Funk, and Harold Caminez. *The Pegasus*, December, 1943.

Universal Joint Catalogue

An illustrated 24-page booklet recounts the history of the manufacturer, and the development of precision universal joints. It includes illustrations of specially designed machines for finishing to a high degree of accuracy and illustrations of various types of joints for special requirements, specifications, data, instructions, etc.

The booklet also contains condensed information regarding two new special accessories for increasing lathe production—the Dix-Wilder Multiple Carriage Stop and the Automatic Collet Closer. The booklet has been prepared particularly for designers, engineers, purchasing agents, and others who have use for universal joints or are interested in procurement of such products. *Dix Manufacturing Company*, Los Angeles.

Catalogue of Testing Instruments

A new catalogue on aircraft and industrial testing instruments is divided into five sections. These cover aircraft gyro test instruments, aircraft vibration test instruments, aircraft industrial production testers, industrial vibration-measuring instruments, and electro-mechanical laboratory and production test equipment.

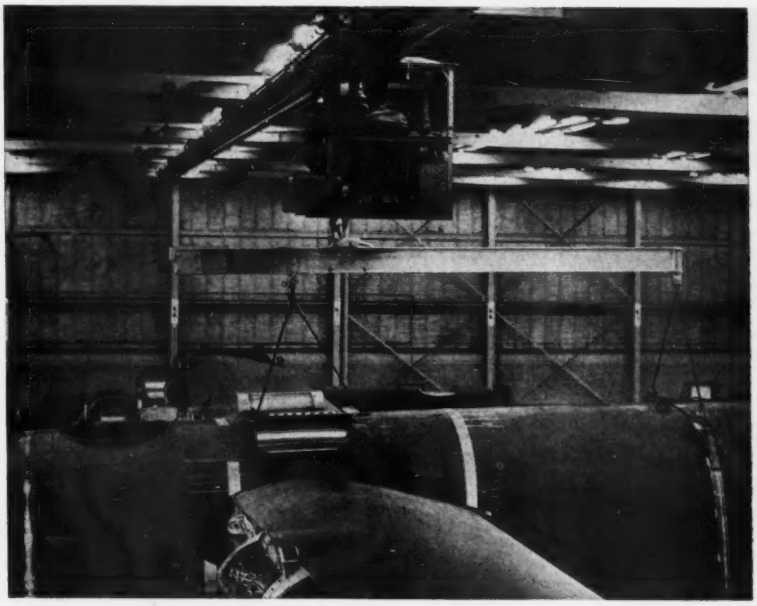
Each section contains pictures and descriptions of the main functions and applications of the listed equipment. These basic instruments are constructed so as to be modified electrically and mechanically to fit the particular application desired. *Televiso Products, Inc.*, Chicago.

Aircraft Control Equipment Catalogue

A catalogue describing equipment and production facilities for fabricating small aircraft parts and accessories is announced. Among the parts produced for aircraft companies are special clips and clamps, various types of manual control assemblies, fork ends, rod ends forged and milled from bar, screw machine and turret lathe products, and small stampings. While this is only a partial list, it includes most of the types of parts produced in the Hyland plant to meet wartime aircraft production needs. *The Hyland Machine Company*, Dayton, O.

Propeller Service Catalogue

Catalogue "H" is an illustrated booklet containing information on necessary tools for the servicing and adjustment of Hamilton Standard Propellers. It covers a hydromatic-propeller test stand, a propeller service table, a bench-type balancing unit, a pit-type balancing stand, and numerous tools and accessories for propeller maintenance. *Airplane Manufacturing & Supply Corporation, Manufacturing Division*, North Hollywood, Calif.



Partially completed Liberator bombers and Liberator express transports are lifted from mating jigs by this specially constructed load bar.

Efficient Lifting Device

Load Bar for Liberators Speeds Lifting Operation. An increase of 300 per cent in the speed of the operation of transferring partially completed Liberator planes from mating jigs to assembly-line carriages in Consolidated Vultee plants is reported as an accomplishment of a single load bar designed by the Plant Engineering Department. The unique feature of the half-ton bar, which is also credited with saving the use of two monorail cabs and one bridge, is that separate shackles provide separate centers of gravity for lifting the two types of Liberators. The offset bar is said to require less time for hookup and break-away than the former method and to avoid the somewhat tedious process of moving the monorail cabs for changing the position of the plane while in suspension. *The Eagle*, November 11, 1943.

Catalogue on Relays and Controls

Bound in a ring binder, catalogue number 4071-D consists of 104 pages of text and illustrations, superseding catalogue number 4071-C. Several types of aircraft relays, including a new line of small, lightweight, and vibration-resisting relays known as "Class S," are featured. Complete operating data and scale mounting drawings are given for these relays, and there are more than 40 other types similarly treated in this book. A double-page chart shows the important characteristics of each type.

Shown for the first time in this catalogue are two desk microphones —a "carbon" and a "magnetic" type —especially adapted for use in airport control rooms. Other items include stepping switches, keys, lamps and lamp holders, solenoids, counters, switchboard plugs, jacks and cords, and various types of microphones, handsets, and transmitter and receiver units for telephone and radio use. *Automatic Electric Company*, Chicago.

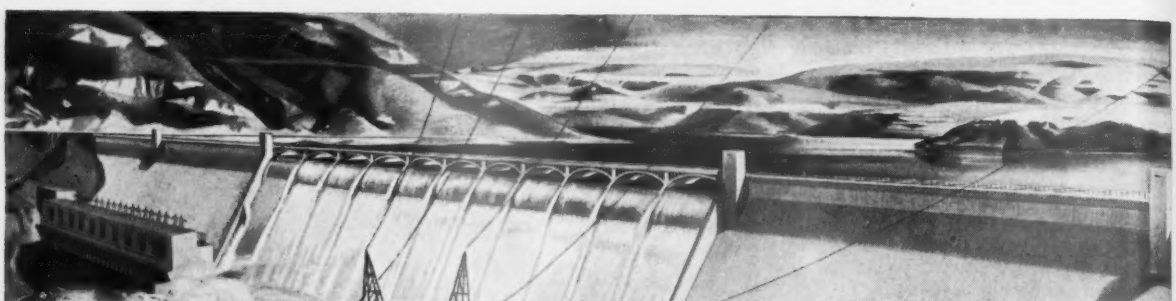
Nonstop Fighter Flight

Midway to Honolulu. The fact that a group of Curtiss P-40 fighter planes flew 1,300 miles from Midway Island to Hawaii is noted. This is called the longest nonstop, mass flight of single-engined military aircraft in American history. To conserve fuel, it is reported that the planes were throttled down and flown at 10,000 ft., except for a short distance flown at 2,000 ft. when bad weather was encountered. *Curtiss Fly Leaf*, September-October, 1943.

Stainless and Clad Steel

Stainless-clad and other composite steels are described in a new catalogue. Included is information on analyses, applications, manufacture, fabrication, styles of heads, and standard size of sheets and plates. It also gives a comprehensive explanation of the patented "assembly method" used in producing Jessop Stainless-Clad.

Of special interest to fabricators contemplating the use of this composite metal are the sections on deep drawings, grinding, polishing, cleaning, gas-cutting, riveting, soldering, welding, etc. *Jessop Steel Company*, Washington, Pa.

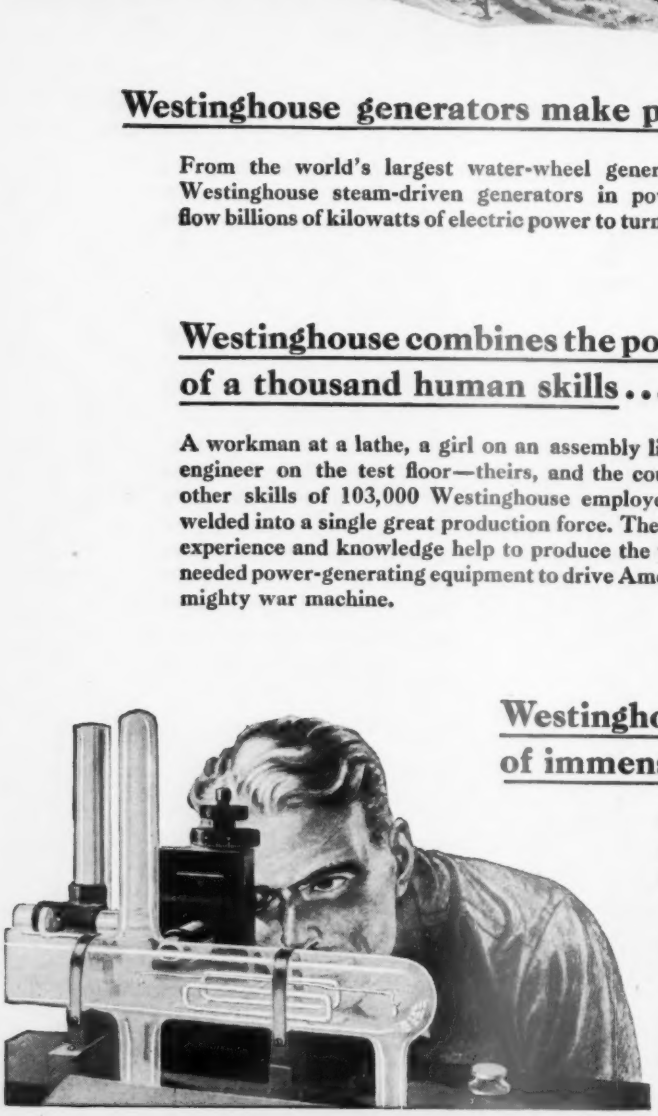


Westinghouse generators make power for a nation at war...

From the world's largest water-wheel generators at Grand Coulee Dam—from Westinghouse steam-driven generators in power plants throughout the nation—flow billions of kilowatts of electric power to turn the wheels of America's war industry.

Westinghouse combines the power of a thousand human skills...

A workman at a lathe, a girl on an assembly line, an engineer on the test floor—theirs, and the countless other skills of 103,000 Westinghouse employes, are welded into a single great production force. Their vast experience and knowledge help to produce the vitally needed power-generating equipment to drive America's mighty war machine.



Westinghouse contributes the power of immense new knowledge...

When the incredible weapons born of wartime research are reforged for peacetime service, the daily miracles that electricity will perform are certain to create new and finer standards of living . . . while the cost of electricity continues to decrease as our nation's power-generating capacity continues to increase. Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Plants in 25 cities—offices everywhere.

Tungsten Electrodes

Tungsten electrodes for atomic hydrogen, helium, and argon arc welding are described in Bulletin 154. Information is given on their physical properties, dimensions, and current range in amperes. *Callite Tungsten Corporation*, Union City, N.J.

Sheet Metal Products

Catalogue Number 15 on aircraft sheet metal products has been published as a guide book for information and data on rivet sorters, exhaust rings, cooling deflectors and other aircraft specialties and equipment. *Engel Aircraft Specialties*, Escondido, Calif.

Production Must Not Lag

The Big Job Lies Ahead. J. Carlton Ward, Jr. With acknowledgment that much of his comments is taken directly from the meeting's minutes, the President of the Fairchild Engine and Airplane Corporation reports on the War Department's September conference with representatives of industry, labor, and publishing. He offers evidence in proof of the assertion that there is no likelihood of an early collapse of either Germany or Japan and stresses the urgent need of continued increased production on the home front. Stressing particularly the production contribution that must be made by the aviation industry, he lists the successes attributed to the use of air power thus far, as outlined by General McNarney. The actual amount of effort required is indicated by the statement that in 1944 the aircraft production rate must show an increase of more than 50 per cent over 1943. *The Pegasus*, December, 1943.

Aircraft Hydraulic Filters

Handbook on Aircraft Hydraulic Filters and Elements in Accordance with Specification AN-F-3 contains twelve sections. The first ten sections describe a special hydraulic filter and element designed for a specific aviation function. Performance charts and specification drawings are shown. The eleventh section illustrates suggested methods of installation, and the final section contains engineering data and formulas. *Purolator Products, Inc.*, Newark, N.J.

Roller Chains

Handbook No. 67 titled, *Baldwin Roller Chain Belts for Aviation*, describes the design of machine-finished roller chains and the application of roller chains to aircraft controls. An accessories section contains information on special terminals and connectors that are used with roller chains in aircraft assemblies. *Baldwin-Duckworth Division of Chain Belt Company*, Springfield, Mass.

National Aircraft Standards

Two revised sheets have been issued for the National Aircraft Standards files. These sheets cover NAS 67 and NAS 68 cowl guide fasteners of the Dzus type. *National Aircraft Standards Committee.*

Flight Research

Airacobra Answer Men. Brief remarks on how flight research has helped in the development of improved Airacobra fighters models. The work of the experimental hangar crew is outlined. *The Bellringer*, December, 1943.

S.A.E. Aeronautical Standards

New and revised Aeronautical Standards sheets of the AS and ARP series have been issued. They cover indicators, airplane heating and ventilating equipment requirements, pins, and internal-combustion type airplane heaters. Other standards sheets cover the nomenclature for aircraft ice-elimination equipment, quench bomb spark-plug tests, service and overhaul manuals for aircraft engines, and humidity-indicator chart. Aeronautical Information Reports Numbers 1, 2, and 3 are also available for sale by the Society at prices ranging from $0.25 to $0.35, to provide the industry with technical data and information obtained in the course of the activities of the Aeronautical Standards Committee but which do not fall into the category of standards or recommended practices. *Society of Automotive Engineers, Inc.*

Electronic Control for Welding

A 46-page booklet consists for the most part of reprints of published articles on the circuits and operation of electronic controls for resistance welding. In the booklet, simplified circuit diagrams are used in explaining the fundamentals of different types of electronic controls built to meet the requirements of individual resistance welding processes and jobs.

The titles of the six articles reproduced in the booklet are: Electronic Welding Control; Seam and Pulsation Welding Controls; Special Welding Controls; Timers for Welding Control; Energy Storage & Welding Controls; and Servicing Resistance Welding Controls.

A pictorial presentation of types of electrical controls for resistance welding follows the articles. Also portrayed are electric accessories for resistance welding processes, including the electrode pressure gauge, the magnetic oscilloscope, cable, capacitors, motors, air circuit breakers and the pointer-stop ammeter. *General Electric Company.*

Production Aids

Dimpling Devices Ease Production Difficulties. A brief article tells how two production difficulties were overcome by an improvement in methods and by an adaptation of a tool to a special kind of work. It was found that shallow dimples were caused by the blocking of the hole for the locating pin with infinitesimal pieces of metal, keeping the pin from entering the proper distance, resulting in raised rivet heads and consequent rejection. The trouble was corrected by piercing guide holes through the bottom set, through eliminating clogged conditions, and by enlarging the dimple-seat hole.

Transformation of a Riv-Nut set into a dimpler made it possible to place the Riv-Nut heads flush in the contour nose skin of a leading edge. *The Fleetwings Arrow*, November, 1943.

Experimental Flight-Test Department

Proving Ground for War. John L. McWilliams. The work of the Experimental Flight Test Division of the Douglas Aircraft Company, Inc., is described. Newly established, this devision consolidates the experimental activities formerly carried on by each individual Douglas plant. It is headed by Donald W. Douglas, Jr. Although details on the division's work are labeled "secret," a general step-by-step account of its procedures is given. *Douglas Airview*, November, 1943.

Screw-Machine Instruction Manual

A manual furnishes instructions on the operation of screw machines for the on-the-job training of screw-machine personnel. In addition to functional machine operation, information is given on tooling. The manual also contains trouble charts and tables of data. *National Screw Machine Products Association, Cleveland.*

Mass Production Factor

In Jig Time. Mason Walsh. In simple terms this article explains what a jig is and how it operates. It tells briefly about the materials and designs of jigs, how they came to be adopted by the aircraft industry, and how jigs differ from fixtures. Demonstrating the usefulness of jigs to the mass production of planes, it lists these advantages: A jig facilitates quicker manufacture of components, more accurate manufacture, the employment of unskilled workers, and the checking of previously manufactured parts. *North American Skyline*, September-October, 1943.

Circulars on Machining Aids

Six circulars have been issued describing steel ink for layout work on dies, templates, and machine parts; a soluble lubricating oil for machining operations; cutting oils for ferrous and nonferrous metals; a sawing lubricant; grinding wheels; and abrasive bands for contour machines. *The Doall Company*, Des Plaines, Ill.

Flexible Tubing

Specifications, performance data, and descriptions of stainless-steel flexible tubing and bellows for aircraft are given in a 30-page catalogue. Charts, photographs, and dimensional diagrams of the products are included. *Chicago Metal Hose Corporation*, Maywood, Ill.

ON NOSE . . . BELLY . . . TOP AND TAI

You'll find Plexiglas TURRETS

ON THE CONSOLIDATED B-24 the new Emerson-designed, Emerson-built nose turret of PLEXIGLAS adds a fourth power-operated death sting to the other three PLEXIGLAS turrets—Martin top, Sperry retractable belly, Consolidated tail.

ON THE BOEING B-17 G —latest version of the Flying Fortress—both the Sperry-designed top turret, built by Emerson and Steel Products, and the Sperry-designed belly turret, built by Briggs and Emerson, incorporate PLEXIGLAS advantages.

ROHM & HAAS C

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides

HARD-HITTING power turrets bristle from American heavy and medium bombers. From nose, belly, top or tail, their guns command surrounding skies... ready to fight off attack from any angle.

These strategic battle stations are enclosed in PLEXIGLAS—Aviation's Standard Transparent Plastic.

The crystal-clarity of PLEXIGLAS enables the gunner to aim and fire accurately. Its strength protects him from wind, weather and freezing slipstreams. Its light weight saves precious pounds for bigger bomb loads and larger fuel supplies.

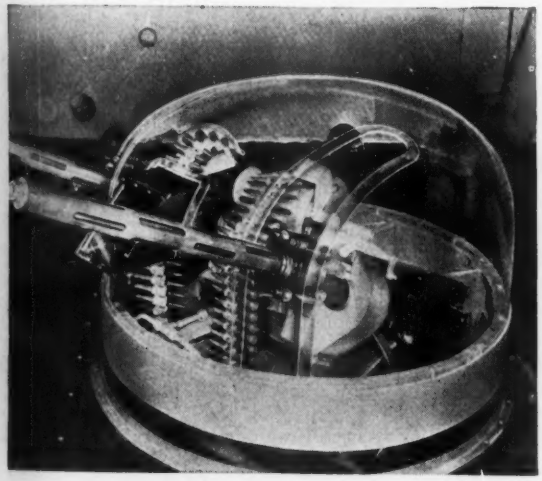
In addition to these inherent advantages, every piece of PLEXIGLAS carries with it the cooperation of the Rohm & Haas technical service staff—physicists to calculate the best optical contours for sighting, engineers to discuss details of mechanical design, production men and facilities to fabricate experimental parts.

To obtain the benefits of this active assistance in your plastics development work, call our nearest office—Philadelphia, Los Angeles, Detroit, Chicago, Cleveland, New York.

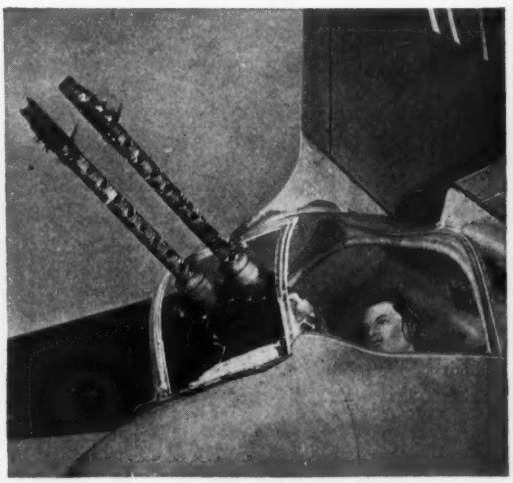
***Only Rohm & Haas makes* PLEXIGLAS.**

3 awards to Rohm & Haas Company and its associated firms, The Resinous Products & Chemical Company and Charles Lennig & Company.

PLEXIGLAS *is the trade-mark, Reg. U. S. Pat. Off., for the acrylic resin thermoplastic sheets manufactured by the Rohm & Haas Company.*



ON THE NORTH AMERICAN B-25—the famous Mitchell medium bomber—the top turret is designed and built by Bendix. Like so many other power turrets on America's best-known bombers, this turret is constructed of crystal-clear PLEXIGLAS.



ON THE MARTIN B-26 both the tail turret and the adaptable top turret—which fights not only on this plane but also on the Consolidated B-24—are made of PLEXIGLAS, to give clear, unobstructed vision to the gunners.

S COMPANY
WASHINGTON SQUARE
PHILADELPHIA, PA.
Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

New Drilling Procedure

Type "E" Drilling—A New Idea. Ray Hermanson. A new type of procedure designed to speed up drilling and reduce drill breakage is described. Called "Type E," the new method utilizes a drill jig with 60° countersunk holes to guide the drill instead of the customary drill bushings. An ordinary spring-loaded safety collar tapered to 60° protects the drill and acts as a guide in centering it in the jig. Specifications covering the work and time requirements are tabulated. *Lockheed Vega Aircraftsman*, November, 1943.

Heat-Treatment of Aircraft Parts

02—Hot and Tough! A description is given of the heat-treating processes used in the manufacture of Beechcraft airplane parts as carried out in the company's Department 02. The development of these processes is outlined. It is noted that the five main processes used are case hardening, annealing, normalizing, stress-relieving, and hardening. Some information is given on how each of these processes is used in the production of aircraft parts. *The Beech Log*, November, 1943.

Additional Sections for Catalogue

Additional sections for the Aircraft Products Catalogue of the United States Rubber Company have been issued. These consist of sections devoted to fuel cells and tanks, life rafts, and fasteners, clothing and miscellaneous items, including coated fabrics for the aircraft industry. *United States Rubber Company.*

British Navy Women Stationed in America

Wrens and Seagulls. A brief article on the posting of 27 members of the Women of the Royal Naval Service at Roosevelt Field, Long Island. Stationed there to make final checkups on Curtiss Seagulls before they are turned over to the Royal Navy, the "Wrens" do not make actual repairs or perform any installation work on the planes. However, each one has a special job of checking to do which requires that she work closely with mechanics and ground-crew personnel. In addition, these Wrens do much of the clerical work required for the transfer of lend-lease planes from the United States to Great Britain. *Curtiss Fly Leaf*, September-October, 1943.

Heat-Treating Furnaces

A 25-page pamphlet titled *Heat and Metals* describes and illustrates heat-treating furnaces installed in various metal working industries. One section of the publication is devoted to furnaces used in the aircraft industry. These include forced-convection furnaces used to heat aluminum for forging, a continuous controlled-atmosphere roller-hearth furnace for bright annealing and normalizing aircraft tubing, and a direct-fired walking-beam furnace for annealing and normalizing stampings. *Surface Combustion Corporation*, Toledo, O.

Air-Line Activities

Global Airlines. William Van Dusen. A historical outline of the development and activities of Pan American Airways. The part Pan American is playing in the war is related. Some remarks are made regarding air-line operations in the postwar period. *The Exchangite*, November, 1943.

War Production Data

Information on metal-working, heat-treating, and the machining of armament is contained in a booklet of war production data. Sections cover preventing rust by displacing water, ordnance and 105-mm. shells, what science has done for lubrication, and machining the M-3 gun tube. *The Houghton Line*, November, 1943.

Comparator Charts

Screw-thread comparator charts have been issued for the entire series of both American National fine threads and American National coarse threads. The elimination of duplicate charts makes possible the checking of from one to seven screw threads on individual charts. *Engineers Specialties Division, The Universal Engraving & Colorplate Company*, Buffalo, N.Y.

Propeller Testing

Tests Prove Reliability of Aeroprop Propeller. How Aeroprop propeller reliability tests are conducted is described with the aid of illustrations. The article outlines how new design ideas are tested in a special experimental laboratory. Tests discussed include vibration tests, propeller breaking point tests, stress-coat analysis, and a series of tests made with special test rigs. *GM Folks*, November, 1943.

Fastening Products

An illustrated book describes how fastening products, such as lock washers and screws, thread-cutting screws, and fastener units, are being used to solve fastening problems in the manufacture of war equipment. One section of the book is devoted to aircraft applications. Other sections cover applications for electrical equipment, communication equipment, automotive equipment, and shipbuilding. *Shakeproof, Inc.*, Chicago.

Aircraft Parts for Maintenance

Spareplanes. In this article it is explained that not all Flying Fortresses produced at the Boeing plant are assembled for operational use. Some come off the production lines in pieces. These provide spare parts for B-17's that have been damaged in service or require replacement because of wear. *Boeing News*, November, 1943.

Postwar Air Transport

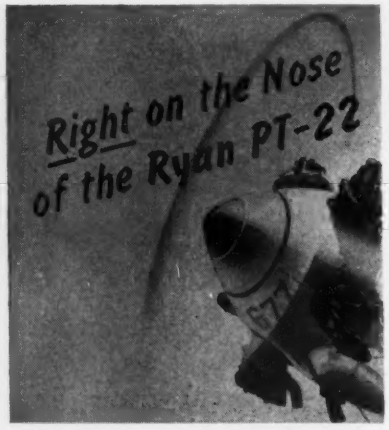
A booklet titled *You—and Postwar Air Transportation*, published for distribution to air-line users, contains questions on what changes passengers would like to see in air transport of the future. A form is provided for answering these questions. *American Airlines, Inc.*

Inspection

"I'll Buy It." Mary Jane Pieronnet. A survey of some of the procedures and equipment of the North-American inspection system. Among the different types of inspectors concerned with the checking of materials, parts, assemblies, and instruments are receiving, mechanical, electrical system, jig, radio, and final assembly inspectors. It is explained that the term "buy" is the stamp of approval when an item has satisfactorily passed inspection. *North American Skyline*, September-October, 1943.

List of A.S.T.M. Publications

A new list of A.S.T.M. standards and tentative standards contains brief descriptions of the various publications issued by the Society, the price of each, and the year of publication. The publications cover specifications, methods of testing, recommended practices, definitions of terms, charts, and tables. *American Society for Testing Materials*, Philadelphia.



PERFORMANCE CONTROLS THE AIR

Vega Ventura

SEND FOR THIS BOOK. Read how radically advanced PESCO pumping equipment opens new opportunities for all industry in more efficient use of controlled liquid flow, pressurized power.

Fair weather or foul, the sharp-eyed crew of a navy patrol bomber is ready for anything. Anti-submarine patrol. Convoy cover. Bombing a naval objective. Laying mines. Making a perilous rescue. Or a task never done before. Whatever the mission, the performance of these gallant naval airmen is legend. So, too, is the performance of the planes they fly, a tribute to the diligence and skill of the men who make them. PESCO Products Co., 11610 Euclid Ave., Cleveland 6, Ohio. (Division Borg-Warner)

In Aircraft Hydraulics, Fuel Pumps, Air Pumps, Related Accessories...

PERFORMANCE POINTS TO Pesco FIRST

Who can use this after the war?

SO far this is definitely a war baby. It was born to meet an exacting wartime need. Every one that is made goes right into the fight.

It is an electric motor designed for jobs which no regular electric motor could fill.

The jobs are on America's fighting planes. Working control flaps—opening and closing cooling shutters—lifting landing gears—and the like.

Every ounce on an airplane is precious. So usual electric motors were out.

This one weighs as little as 8/10ths of a pound—others can move as much as 35 tons.

Naturally it took a whole new kind of engineering to make this motor.

It took new ideas from the drawing board up. It took new materials—like glass-insulated wire—to build it. It required finer, more precise craftsmanship than had ever gone into a motor before.

After the war, these motors can be sold to manufacturers of peacetime products.

That is why we are telling you about them now.

You may have need for such a compact, ultra-efficient source of power. You may be able to use the kind of engineering thinking that developed it—or the production technique that builds it and about 250 other Lear products.

PLANTS: Piqua, O., and Grand Rapids, Mich. BRANCHES AT: New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.

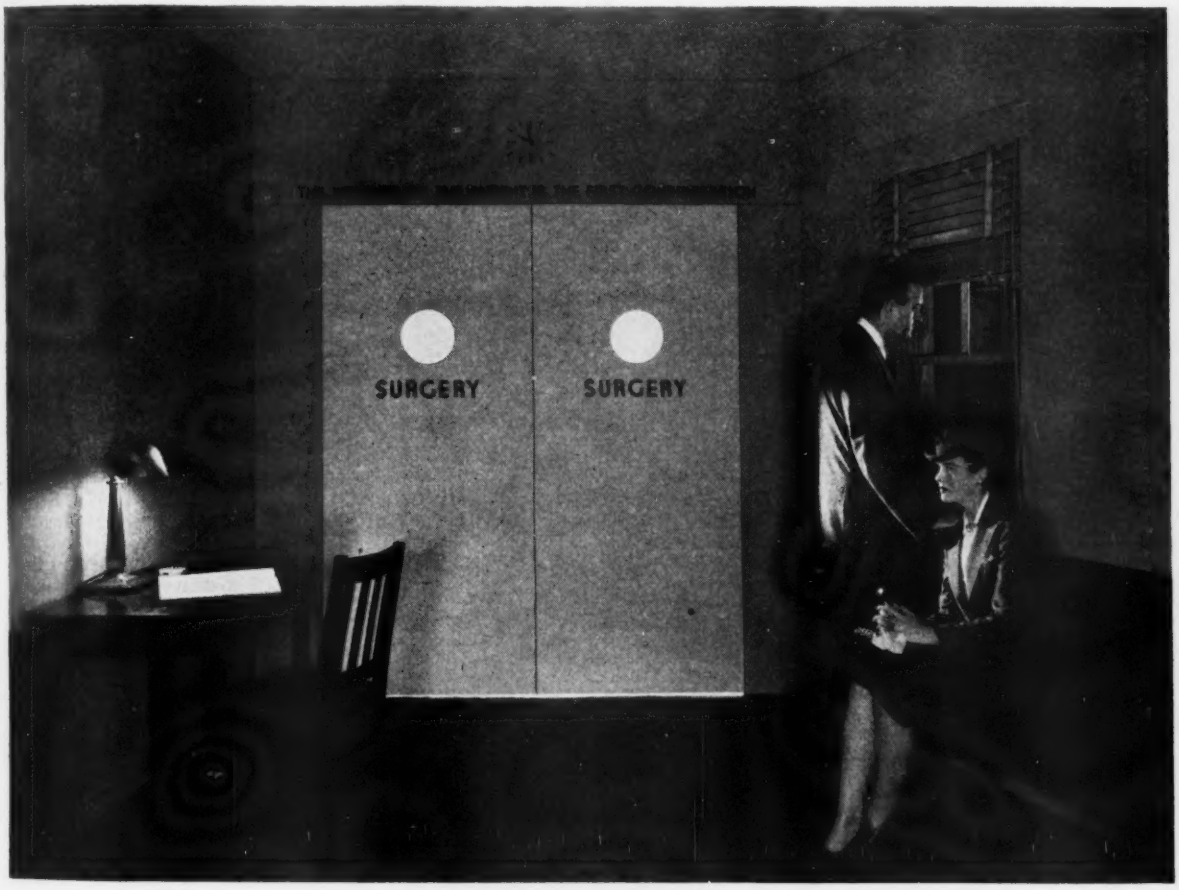
LEAR AVIA INC.
PIQUA . OHIO

When life and death ride on a slender needle . . .

If you have ever walked into the white hush of a modern operating room you have seen the metered instruments on which the surgeons depend as the age-old battle of life and death is fought across the operating table. These meters must be true. They must be unfailingly precise. Life itself depends upon them.

It is measuring, metering, and testing equipment of this kind—equipment that accepts the responsibility of *sustained accuracy**—that is built by Boes. Whether it be for the professions, the sciences, or for production, a Boes-made instrument is worthy of the work that it must do.

***SUSTAINED ACCURACY** is not an easy quality to achieve. It must take into account all factors of use—must then employ the design, the alloys, the construction that infallibly protect an instrument against all threats to its reliable performance. Such instruments, obviously, must be built with performance—not price—in mind. We invite the inquiries of those who are interested in such standards.



Boes *instruments*

for Measuring, Metering & Testing Equipment ☆ The W. W. Boes Co., Dayton, Ohio

INDIUM

Use It and Obtain These Advantages

- **Increase the Hardness of Non-Ferrous Metals**
- **Protect Surfaces against Wear**
- **Protect Surfaces against Corrosion**

WEAR AND CORROSION . . . two "gremlins" against which design engineers are ever on guard! Let these two fifth columnists loose in a plane and anything can happen.

Where non-ferrous metals are concerned, wear and corrosion problems are being solved by the use of INDIUM. It's the "vitamin" for *all* non-ferrous metals. A percent or two works wonders not only in protecting against wear and corrosion but in other ways. Bearings, plated surfaces, solders, contact points . . . these and many others have had their usefulness increased greatly by the addition of INDIUM.

The use of INDIUM should be investigated for *every* problem associated with non-ferrous metals. And it's an *available* alloying metal. We can supply both INDIUM Metal and INDIUM Salts in commercial quantities.

We'll be glad to have you write us about your problems.

ARMY E NAVY

THE INDIUM CORPORATION OF AMERICA Pioneers 40

The INDIUM *Corporation of America*

UTICA, N. Y.

New York Office: 60 East 42nd Street

P-40 in Africa

Airpower Paved the Way for Italy's Surrender. Roosevelt Der Tatevasion. The third installment of the *Battle Saga of the P-40* is devoted exclusively to the North African campaign. In a detailed step-by-step account, the performance record of P-40 fighters and fighter bombers is reviewed through the entire advance from El Alamein to the Italian mainland. *Curtiss Fly Leaf*, September-October, 1943.

Plywood Joining

Aero Research Technical Notes, Bulletin No. 11 describes the fundamental principles of the edge-to-edge joining of plywood. It covers the methods and materials used in this work and the machinery needed to accomplish it. Instructions and technical information are supplemented by a chart showing the amounts of adhesive required for specified glue lines and various thicknesses of veneer. *Aero Research Ltd.*, Duxford, Cambridge, England.

Pamphlet on Heat-Treating

The Heat Treating Furnace is a booklet prepared for users who have only recently experienced the necessity for heat-treating and for groups charged with the responsibility of converting war production facilities to the products of peace. For the first group it will constitute a background of knowledge of industrial furnaces, and for the others it is intended to introduce the heat-treating furnace of the future.

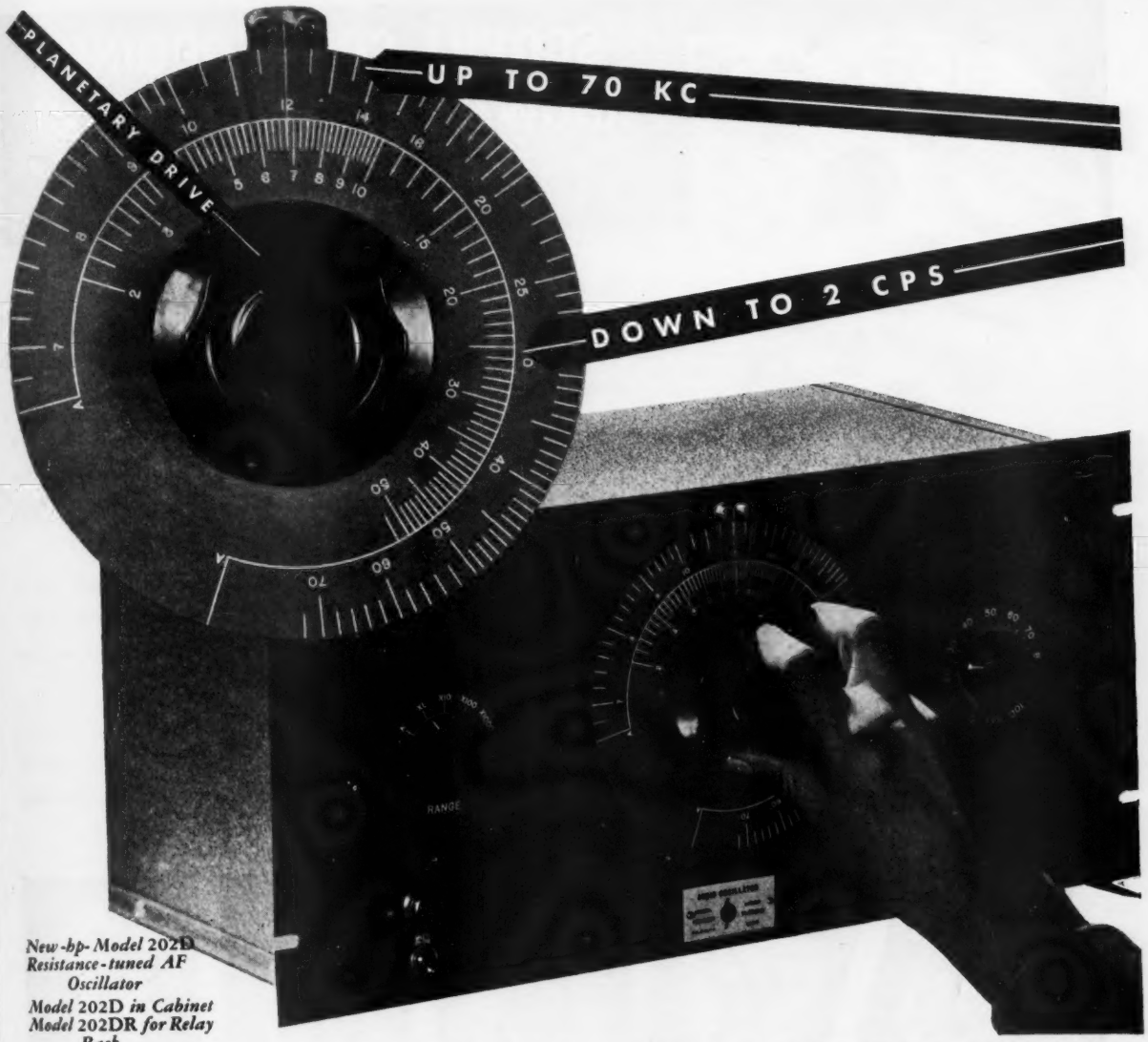
The first section defines different types of furnaces, briefly traces their history, and tells the purposes for which they are used. Another section covers the contribution of the development of heat-treating research, and the third section indicates the improvement that may be expected in future equipment of this type. *Surface Combustion Division of General Properties Company, Inc.*, Toledo, O.

Service Tools for Curtiss Electric Propellers

Catalogue C includes 16 pages and covers a line of service equipment for use with Curtiss Electric Propellers. It has a numerical index giving the name of each tool, the maker's number, and the equivalent Curtiss number. The text pages give a number of descriptions and sketches of each tool and its operation. *Airplane Manufacturing and Supply Corporation*, North Hollywood, Calif.

Getting the Engines Ready

Power in Pliofilm. Dorothy Chandler. An account of how the Douglas Aircraft Company, Inc., fits miscellaneous parts into aircraft engines, tests the engines, and installs them in airplanes. The process is traced . . . . from the time the "power plant" is delivered to Douglas by the engine company, until the Army Air Forces makes the final test flight. *Douglas Airview*, November, 1943.



New -hp- Model 202D *Resistance-tuned AF Oscillator*
Model 202D *in Cabinet*
Model 202DR *for Relay Rack*

Interested in LOW FREQUENCIES?

This newest addition to the *-hp-* line of Resistance-tuned Audio Oscillators provides you with all the excellent features found in its predecessors plus a range of available frequencies heretofore not provided. Large, easy to read dial has two scales extending over 270° rotation. Smooth planetary drive with a 5 to 1 reduction makes it easy to control. The outside scale is calibrated for frequencies from 7 cps to 70 kc. The inside scale is calibrated for frequencies from 2 cps to 50 cps. All calibrations are for direct reading. A resistance-coupled power amplifier provides uniform output over the entire range. The instrument is extremely stable, having a frequency drift of less than ± 2% even during the initial warm-up period. Line variations of as much as 20% will change the frequency less than ± 0.2% at 1 kc. As with all *-hp-* AF oscillators *no zero setting is required.* Write today for more complete data. Give us details of your problem so that we can be of utmost assistance. Ask for your copy of the 24 page *-hp-* catalog which gives much valuable information about electronic instruments. There's no cost or obligation.

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HEWLETT-PACKARD COMPANY

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491

SCOVILL COLD-FORGING "KNOW HOW" CAN HELP YOU

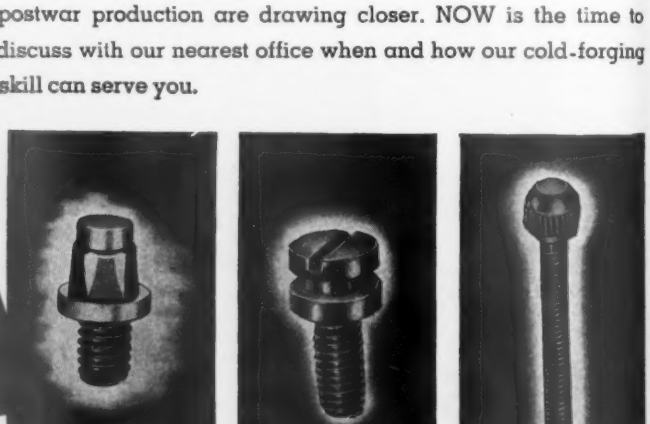
with your war and post-war screw products needs

Here are a few of the many practical proofs that Scovill has the cold-forging "know how" to solve your special and standard screw products problems for minimum money—materials—motions.

Some are newly designed war jobs—others civilian—still others are prewar products now important in war work. *All* are the result of years of demonstrated Scovill ability to find the *best* way to make screw products *right*.

Today this "know how" is largely engaged in war work. But it is neither new nor adaptable only to war products. Behind the added ingenuity born of wartime pressure and shortages, are years of unusual peacetime skill.

This war is far from over—but the practical problems of your postwar production are drawing closer. NOW is the time to discuss with our nearest office when and how our cold-forging skill can serve you.



Please Note: *Kindly pass this on to others in your plant. We are still handling new work to the limits that current war commitments permit, stating the situation promptly and frankly.*

SCOVILL MANUFACTURING COMPANY

WATERVILLE SCREW PRODUCTS DIVISION

WATERVILLE 48, CONN. TEL. WATERBURY 3-3151

NEW YORK, Chrysler Building • DETROIT, 6432 Cass Avenue • CHICAGO, 1229 W. Washington Boulevard • PHILADELPHIA, 18 W. Chelten Avenue Building
PITTSBURGH, 2882 W. Liberty Ave. • SYRACUSE, Syracuse-Kemper Insurance Bldg. • LOS ANGELES, 2627 S. Soto St. • SAN FRANCISCO, 434 Brannan St.

From the Industry

Changes Proposed for Aeronautical Chamber

Active participation by chief executives of leading aircraft manufacturing companies in the Aeronautical Chamber of Commerce, together with a possible change of name of the organization and possible limitation of membership to manufacturers, were forecast at the annual meeting of Chamber members in December.

Pending necessary changes in by-laws, the election of a new Board of Governors comprising industry leaders and decision on the other questions were deferred until a special meeting of members to be held in the near future.

James P. Murray, president of the Chamber and vice-president of Boeing Aircraft Company, told the meeting that a tentative suggestion for a new name of the organization was "Aircraft Industries Association," designed to identify it more clearly as a trade association representing the aircraft manufacturing industry.

The new Board of Governors is expected to include heads of six west coast and six east coast manufacturers of air frames and/or engines, two manufactures of aircraft parts and accessories, and one representing other members. It is proposed to hold regular meetings alternately on the west coast and east coast, coinciding with meetings of the Aircraft War Production Council.

Proposed nominations for officers to be acted upon by the new Board of Governors were: Chairman of the Board, Donald W. Douglas; President, J. Carlton Ward, Jr.; Vice-President, La Motte T. Cohu; Vice-President, L. D. Bell; Treasurer, H. W. Cohu; Secretary, I. H. Taylor. President Murray indicated that the new president to be elected from the industry would serve only until a new full-time chief executive had been selected. Aeronautical Chamber of Commerce of America, Inc.

Medium-Duty Dust Collector

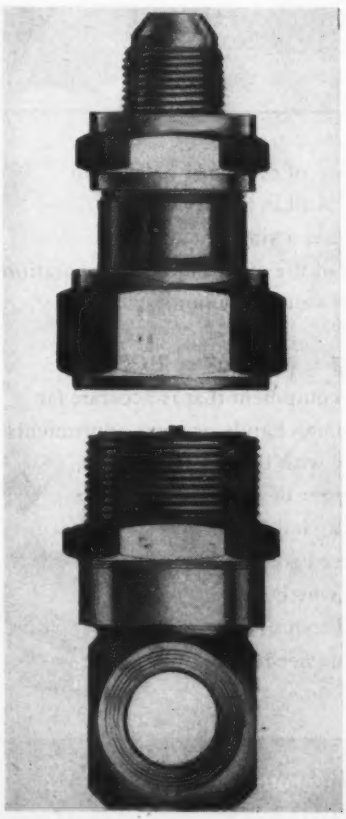
A portable, self-contained dust collector of the cyclone-filter type for exhausting dust and dirt-laden air from most types of medium-heavy abrasive operations has been developed.

The new unit is entirely self-contained, having a multiple blade fan direct-driven by a continuous-duty motor and a removable spun-glass filter, as well as the cyclone-type separator. This combination allows the cleaned air to recirculate into the working space and reduces heating losses.

It is stated that the efficiency of the cyclone separator permits continuous operation without frequent changing of the filter. This collector is intended particularly for collecting dust from protection grinding operations on big wheel surface grinders, medium size double-end grinders, discs, cutoffs, and emery and belt sanders. Rating of the Model 950 Dustkop is listed at 490 cu.-ft. per min. with a single 5-in. inlet, using a $^1/_3$-hp. continuous-duty motor. Air velocity of 4,450 ft. per min. is provided. Aget-Detroit Company, Ann Arbor, Mich.

Self-Sealing Coupling

A disconnecting self-sealing coupling, designed to withstand 2,500 lbs. per sq.in. after ordinary finger tightening, is a recently reported development.



American Screw Products self-sealing disconnect coupling.

Tests under severe handling conditions are claimed to show that the heavy construction of the aluminum-alloy body prevents distortion and that jamming of the spring-loaded shut-off valve is prevented. One sample coupling was purposely crush-tightened with a long-handled wrench yet is reported to show no leakage upon disconnection or reassembly.

Springs are of heat-treated steel. Lightweight cast phenolic poppets are designed to be positive-sealing in action, and the synthetic gasket provides a leakproof connection when coupled for service. The couplings are available with A.A.F. or AN threads. American Screw Products, Los Angeles.

Instant-Release Hinges

The Burklyn instant-release hinge is made up of a bracket that houses two spring-loaded attaching pins. As the pin at each end is retracted by finger pads, the hinged part is instantly released. The hinges are now available as complete sets in a wide variety of nonstrategic materials. Formerly, only the male hinge was offered. These hinges are intended for many applications: on ammunition chutes, map cases, tables and shelves, bulkheads and partitions, seats, cowlings, inspection plates, removable instrument panels and instruction boards, test equipment, scheduling boards, and pilot curtains. Burklyn Company, Los Angeles.

Adjustable Blade Counterbore

An adjustable blade counterbore and spotfacer differs from conventional "adjustable" tools in that instead of having a group of fixed-diameter bits interchangeable on a standard shank the blades themselves are adjustable to any diameter within the limits of the tools. Each of the interchangeable pilots is so designed that burrs are prevented from forming at the edge of the pilot hole, which tends to avoid "locked" pilots and the resulting damage to the tool and the work.

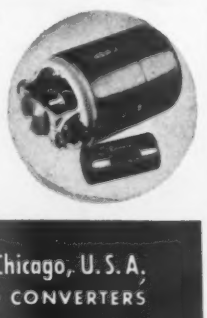
The complete range of eight sizes of the new counterbore and spotfacer covers all fractional and decimal diameters from $^9/_{16}$ to $5^1/_2$ in. and provides interchangeable pilots from $^3/_{16}$ to $5^1/_4$ in. in diameter. Robert H. Clark Company, Los Angeles.

Piston Decarbonizing Process

A new process for cleaning aircraft engine pistons embodies the use of chemical solvents supplemented by a mechani-

In Physics, the definition of the word *balance,* in brief, is: "*to be in equipoise.*" And in the EICOR lexicon, that versatile word has a similar meaning. It designates one of the most important operations in the building of fine motors and dynamotors.

Precision balancing is a "must" at EICOR. Every armature is tested on equipment that is accurate far beyond the perception of human hands or eyes; adjustments are then made in accordance with these test readings, to the preciseness of the weight of a human hair. But such accuracy pays, for it is a vital factor in producing the quiet, long-lived rotary units bearing our name . . . units which today serve the Armed Forces, and tomorrow will best serve your peacetime needs.



EICOR INC. 1501 W. Congress St., Chicago, U. S. A.
DYNAMOTORS • D. C. MOTORS • POWER PLANTS • CONVERTERS
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cal hydraulic blast, to which is added a cereal or plastic abrasive. It is asserted that pistons in service 1,000 hours may be cleaned with this hydroblast process in less than one-third of the time normally required. The process is stated to be particularly applicable to flow production methods of engine overhaul and assembly. The Curran Corporation, Malden, Mass.

Corrosion-Resisting Plastic

What is believed to be one of the largest Saran parts ever to be injection-molded is a 35-oz. plating mask for use in chrome-plating aircraft landing-gear struts. These parts are fabricated by the St. Louis Molding Company and require a molding cycle of only 70 sec. on a modified Watson Stillman machine.

Because of its high chemical resistance, lightness, and metal-like strength and toughness, Saran was found to be especially fitted for use as an impenetrable mask, to localize the chrome treatment to the desired area, and to prevent plating other parts of landing gear. The plastic is reported to be unaffected by the highly corrosive elements of the plating solution.

Another application of Saran, recently made public, is for a transparent air- and watertight film to protect metal armament from rust and corrosion in transit to the battle fronts. Formerly, parts of machine guns and other metal ordnance were protected by a heavy coating of grease which had to be carefully removed before guns could be assembled. The Dow Chemical Company, Midland, Mich.

Packaging Material

A new translucent "skin" for protecting machine parts in shipment has been developed. The product is a plasticlike substance having an ethylcellulose base and is applied by a hot-dip process. It sets quickly into a tough coat which is stated to fully protect metal from rust, corrosion, and dirt.

The coating is easily stripped off with a pocket knife. The types of parts which can be treated by the new product are not yet fully defined, but it is indicated that it will greatly reduce packaging time. The Dow Chemical Company, Midland Mich.

Largest Spar Miller

What is stated to be the largest spar miller ever built has been delivered to a well-known aircraft manufacturer.

The new machine is similar in design to other high-speed spar millers which are being used for fabricating spars. The overall length of the machine is 91 ft. with a table length of 80 ft. Two carriages having a total of six milling spindles travel the length of the bed during the milling operation. The two carriages operate independently of each other. They are used simultaneously when milling long spars, performing as many as six operations at a

time, or independently on short spars. The machine was designed for Farnham by Paragon Research, Inc. Farnham Manufacturing Company, Buffalo.

Cutting Lubricant

A cutting-tool lubricant, developed to dissipate heat faster and allow higher cutting speeds, has been introduced. It is known as Hydromite and is not a soluble oil but a true water solution that is stated to possess extreme oiliness, high film strength, and antiwelding properties. Being concentrated, it is only necessary to add water to obtain the correct solution for the individual job. It is stated the new lubricant is easily removed from finished work and does not have an objectionable odor. Filmite Oil Corporation, Milwaukee.

"Lectrofilm," A New Material for Capacitors

Lectrofilm, a new synthetic dielectric material for capacitors, was developed after several years of laboratory research and made of materials available in the United States. It is applicable, in place of mica, to the manufacture of most radio-frequency-blocking and bypass fixed capacitors used in communications and other electronic equipment. It is available in both rolls and sheets and is intended to be used in present capacitor production lines with little change in equipment or method of manufacture.

The makers state that strength and flexibility of the material make it well suited to automatic methods of manufacture. The careful control used in its production, together with its chemical stability, assures uniform properties and freedom from defects. Furthermore, it requires little grading or sorting before being placed into a capacitor production line. Compared with other dielectrics, Lectrofilm requires less inspection and, properly applied, its use will cut down the number of finished capacitors that are rejected in test, thereby reducing the amount of labor and increasing production with present facilities. General Electric is making Lectrofilm available for use by manufacturers making capacitors for the armed forces. General Electric Company.

Spotlight for Arc Welding

A new spotlight, designed to provide glareless illumination of sufficient intensity for an arc-welding operator to see his work distinctly through the dark lens of a welding helmet prior to striking the arc, has been developed. This spotlight is particularly suitable for production-line welding in which the establishment of the arc must be made quickly and accurately, such as in the welding of thin materials, light-alloy castings, and aircraft parts.

Mounted on an upright telescoping metal standard and set in an $18\frac{1}{2}$-in. diameter, 30-lb. cast iron base for stability, the spotlight consists of three 300-watt reflector spot lamps surrounded by a circular shade. Rated to give 1 000 hours of continuous operation at 120 volts, the lamps are mounted in adjustable porcelain holders so that the area covered by the light beam can be increased from a single sharp spot 7 in. in diameter to a clover-leaf shaped pattern approximately 17 in. across at its widest point.

The light can be raised or lowered on its standard, and held in place by a locking thumb screw, to any point from 45 to 76 in. above the base. A universal, friction ball-joint between the shade and the upright standard permits the light beam to be directed and held at any angle downward between vertical and 30° below horizontal. The lamp is controlled by a foot-operated switch which is depressed by the operator while the arc is struck. General Electric Company.

Fixture for Drilling and Boring

A double indexing fixture that facilitates machining close-tolerance holes at specified intervals about the circumference of a small, round aluminum housing has been devised. The housing is composed of an upper and lower section and, when the holes, each 0.503 in. in diameter, are machined, one-half of each hole appears in both sections.

Formerly, this operation consisted of spot drilling and reaming in a drill jig. The jig was clamped centrally with the spindle and each hole indexed in turn. The specified smooth finish was difficult to produce, the fixture was hard to keep clean, and the jig had a high maintenance factor, having been rebuilt five times. For best results in assembly, experienced operators and assemblers were required to remove the burr caused by reaming.

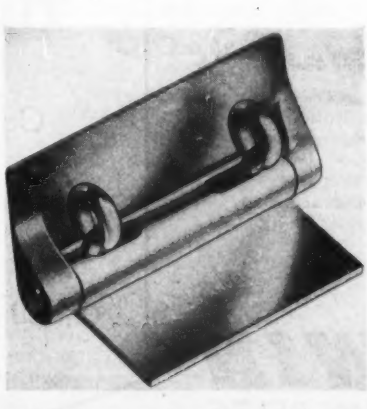
The new fixture, designed for use on a double-head Borematic machine, has been developed to solve the problem. Special twin boring bars, with drill tips inserted to pilot the boring tool, are used with the fixture, which is mounted on a channel-shaped fabrication of $\frac{3}{4}$-in. steel plate, with a bottom side longer than the top. The bottom of the plate acts as a base for holding the indexing mechanism and the shorter top serves as a mount for the work. The upper extension is supported by two posts at each end, as well as by the connecting side of the channel section.

The indexing mechanism consists of a 16-hole index plate assembled to a centered spur gear, at each side of which are gears of equal diameter. The center distance of the shafts, to which the other gears are attached, is within the adjustable range of the machine heads, and thus permits machining two pieces, side by side, simultaneously.

Attached to each shaft is a mounting plate with a short locating pin for each piece. The pieces are positioned over each shaft, the diameter of which permits easy loading and unloading. A large flat washer distributes the holding pressure applied by threading a four-winged nut over the end of each shaft.

Each piece is indexed by first releasing a long vertical locking pin extending from the enclosed index plate to the base plate of the fixture. This is done through lever action of the lower attached handle. Next, the upper handle, operated horizontally, in the manner of a ratchet from the center of the mechanism, serves to position each succeeding pair of holes for machining. A pin is inserted in the first hole after drilling and boring, as a precaution against possible movement of pieces in the fixture.

This method is stated to have reduced the time for this operation from 30 to $4\frac{1}{2}$ min. General Electric Company.



Burklyn instant release hinge. (*See* page 159.)

Glider Institute Formed

A report has been issued on the formation of the Glider Institute of the Americas, Inc. The three announced purposes of the Glider Institute are: first, to provide an authoritative source and clearing house of available information on military and commercial developments and uses of gliders and towed planes; second, to accord proper recognition to individuals and organizations making outstanding contributions to the progress of gliders; third, to aid glider manufacturers, users, and enthusiasts in their common problems. Selection of officers of the new organization will be made shortly. The Glider Institute of the Americas, Inc.

Aircraft Special Rivets Now Available for Other Industries

A one-piece combination rivet, called "Rivnut," originally developed to fasten deicers to airplane wings, is now being produced for general industrial use under priority rules. The rivet is of threaded and tubular design. By means of a special tool, it can be headed on the inside of the sheet to which it is applied while working entirely from the outside. This makes it possible for parts to be fastened to otherwise unreachable inside surfaces. The rivet is made of aluminum alloy. The B. F. Goodrich Company.

SO LITTLE

TO MEAN SO MUCH

Just a small strand of chain . . . not large, not important looking . . . yet it and others like it govern and coordinate with unfailing accuracy, the hundreds of parts that control the flight of a war plane.

For that chain is a strand of Baldwin Roller chain belt, whose unfailing smoothness of operation, elimination of jerkiness and "freezing," high strength to low weight ratio is responsible for its wide preference by airplane manufacturers.

In as many as 39 points, Baldwin Roller chain belts and terminals control and direct operations, among them such important points as:

Ailerons	Nose Wheel Doors
Wing Flaps	Sliding Hood
Rudders	Power Turrets
Elevators	Arresting Hook
Bomb Bay Doors	Retractable Landing Gear
Tail Wheel Doors	Control Column

For complete information on Baldwin Roller chain belts for aviation, write for your copy of the interesting, informative Engineering Handbook No. 67. Baldwin-Duckworth Division of Chain Belt Company, 355 Plainfield Street, Springfield, Mass. Factories at Springfield and Worcester, Mass.

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"Overcoats" for Fuel Tanks

Synthetic rubber is being used for gasoline-absorbent "overcoats" on bullet-sealing fuel tanks in warplane wings. The overcoats absorb any slight amount of gasoline which may escape from a fuel tank after it is pierced by a bullet and before the hole seals itself. Prior to adoption of the synthetic rubber overcoats, these slight amounts of escaping fuel tended to form highly explosive air mixtures within warplane wings because of the fuel's high volatility.

Foamed synthetic rubber is produced for the overcoats in sheets about 1/4 in. thick. These sheets are fitted to the tank after it is installed within the wing. Goodyear Tire & Rubber Company.

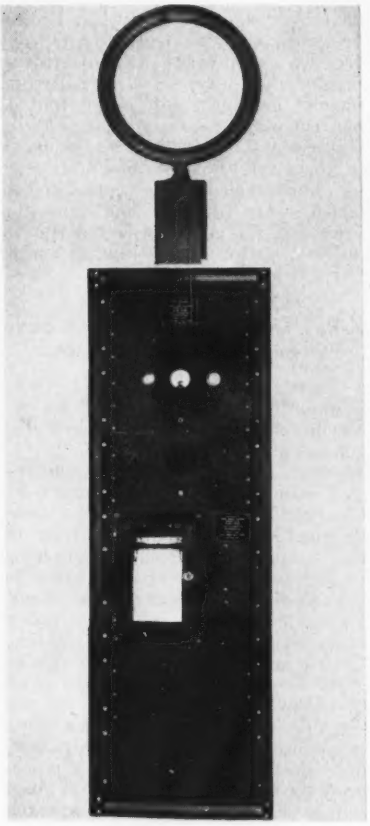
Navigation Instrument for Life Rafts

A new celestial navigation instrument, combining a sextant for use during the day with a quick means of determining true north, sun time, latitude, great circle course, and direction has recently been designed especially for use in life rafts. The instrument, made entirely of corrosion-proof Plexiglas plastic and weighing about 1 lb., will float in water and is stated to be clearly visible even at night. The use of this celestial sphere on a life raft is intended to eliminate the need for a nautical almanac, sextant and compass, and involved calculations to determine approximate positions.

The instrument combines a miniature of the celestial sphere, with the names and locations of the 22 navigational stars, and a world globe with all coordinates. It has the means of reproducing the movements of all celestial bodies used in navigation exactly as they are seen from any point on the earth's surface. With the proper settings and the instrument level, the rays of light from the sun are passed upon the world globe from sunrise to sunset. While in this position, the altitude and azimuth may be measured. The instrument also can be used for teaching celestial navigation. Frederick H. Hagner, inventor and manufacturer, San Antonio, Tex.

Welding Positioner

A welding positioner having a capacity of 2,500 lbs. and designated as model WP-2 has been designed for production-line welding as well as job work and maintenance. The construction throughout is all-welded rolled steel. The table is 42 in. in diameter, has 18 radial slots for mounting fixtures, and is turned manually to suit the welding speed. Tilting is controlled by hydraulic power and a position 130° beyond the horizontal is attainable. Both table movements have positive locking devices. A telescopic column with self-locating stops provides for a table elevation of from 28-in. minimum to 60-in. maximum from the floor, depending on the type of mounting. Either portable or column-in-floor mountings are provided. Harnischfeger Corporation, Milwaukee.



The Islip Radio Manufacturing Corporation's radio range monitor.

"Blind" Rivet Driver

The Thor RIV-Driver is designed to drive four "blind" rivets per minute in aircraft production. It is pneumatically operated and is intended to drive and buck in one operation the "blind" rivets on finished plane sections to which are connected deicers, instrument panels, and other light assemblies.

The tool operates in a four-step cycle and features a light at the top of the handle which flashes a signal to indicate to the operator when the rivet has been accurately upset on the blind side. The first step in the cycle screws a mandrel into the rivet; the second step pulls back the mandrel, upsetting the rivet and flashing on the signal light; the third step unscrews the mandrel; the fourth shuts off the tool, completing the cycle and making it ready for the next operation. Full details are available in Bulletin No. 247. Independent Pneumatic Tool Company, Chicago.

Lock-Type Protractor

A new pocket-size, lock-type protractor is designed for accurately measuring angles of drill points, tool bits, machine ways, and depths of deep holes and for sketching and laying out tools and machine parts.

The adjustable lock-type sliding scale pivots the full 360° and is stated to permit the measurement of any angle to an accuracy of 1/2°. Deeply etched graduations afford easy readability, even in poorly lighted shops.

A locking device on the vernier turret rigidly secures any specific measurement or angle by locking both the vernier turret and the sliding scale. Industrial Engineering Company, Chicago.

Automatic Radio Device for Airway Safety

One of the important recent devices developed for the improvement of airway safety is the automatic radio-range monitor. Under certain weather conditions, or because of malfunctioning, the four radio courses projected by a radio-range station will sometimes shift without warning to the pilot or may even stop functioning.

The new radio-range monitor is designed to eliminate this danger by providing, to both the fliers and the ground crews, instant warning if any radio course shifts as little as 3° from its normal setting or fades below its normal strength. The monitor may be adjusted to operate all warning devices with a range course shift of less than 1°. Eventually it is expected that all ranges will be so monitored.

The course monitor receiver is located 1,200 ft. from the radio-range station, directly on the radio course, and is connected through a telephone line to an indicator panel in the airport control room. Four receivers are required for all the four radio courses of the standard government four-course radio range. So long as the radio course does not shift, the monitor receiver continuously picks up the interlocking A and N signals transmitted by the range station. If the course shifts, either the A or the N signal begins to predominate, the amount of the course shift being indicated by the comparative difference in strength between the A and the N signals. When this happens, the monitor receiver automatically transmits an electrical impulse to the monitor board at the airport, which flashes a red light and sounds a siren to warn the ground crew; at the same time the monitor automatically dials the range transmitter, which instantly begins to send out to all pilots a warning signal at the end of each A-N cycle.

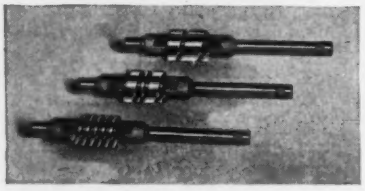
The same warning is given by the automatic monitor if the link circuit relay fails to interlock the A and N signals correctly or becomes locked, if the output of the radio-range station drops below a predetermined level, or if more than one-half of the range station identification call is not being transmitted.

The functioning of the monitor receiver presents numerous electrical features. To measure the comparative strength of the A and N signals more accurately than can be done by a human ear, the receiver automatically divides them and feeds them into separate channels. After the two signals

PRECISION PARTS

WORMS

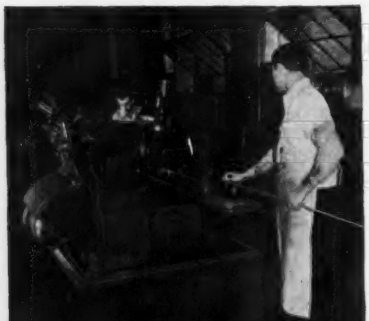
To Bait the Enemy



The worm as turned.

Precision-machined parts for what it takes to destroy the enemy—Ace is turning them out by the thousands. (Ace has an Axis to grind!) These hardened-steel worm-shafts, for example, are part of vital radio equipment. The triple-lead worm-thread is ground right from the solid blank, after hardening. This insures the concentricity between the pitch-diameter of the worm and the bearing-diameter. The bearing-diameter itself is ground to a total tolerance of .0003".

Since the war began, Ace has been supplying America's outstanding manufacturers with small parts and assemblies calling for stamping, machining, heat-treating, or grinding. Ace has provided not only the industry's most modern equipment, but the skill, the background, and the ingenuity to use those machines in new ways to improve results, shorten schedules, and get the work out. Keep Ace up your sleeve for post-war plans. Occasional capacity is available for current work.



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have been equally amplified and rectified, the resultant direct currents from the two channels are fed, in opposite phase, to a balanced bridge circuit. Should the course shift, the output of one channel becomes greater, causing the pointer of the indicating instrument on the control board to move, showing how much the course has shifted and to which side; at the same time the warning light and the siren begin to operate. Islip Radio Manufacturing Corporation, Islip, N.Y.

X-Ray Equipment for Study of Body Reactions at High-Altitude Equivalents

In order to study visually the reactions of the body at the simulated equivalents of altitudes of 35,000 to 40,000 ft., industrial engineers and the staff members of the University of Cincinnati Engineering College have designed X-ray tubes and equipment to function properly at the low atmospheric pressures prevailing without harm to the unit or to those using the equipment. Power at 125,000 volts was safely insulated to enable the X-ray machine to be taken into the flight chamber at pressures equivalent to altitudes of up to 50,000 ft. Incorporated in the "stratospheric" X-ray unit was a built-in synchronized technique for radiography known as the Techron, a peacetime development that has been given further refinement as wartime research progressed.

How the X-ray unit is employed to record the changes in the body developed in the presence of bends, chokes, and abdominal cramps was demonstrated at the recent meeting of the Aero Medical Association of the United States. These X-ray pictures showed that the principal bends are related to the presence of gas bubbles in the body tissues. X-ray pictures taken during the bends reveal that the tissues take on a sort of "swiss cheese" appearance.

The bubbles form similarly to the development observed when a bottle cap is removed from a capped carbonated beverage. The X-ray shows that gas bubbles disappear when the "testee" has returned to "the ground" where the atmospheric pressure is higher. The research scientists pointed out that the X-ray studies indicate that "aviators' bends" are related to bubble formation in the tissues and not in the blood as was originally believed. As a result of this discovery, the scientists believe that the bends—caused by bubble formation in the tissues—are not so dangerous to human life as if the formation were in the blood.

The X-ray's photographic record demonstrated in recording the reactions from "the chokes" that this disorder is not caused by severe disturbances in the heart and lungs. The radiographic record revealed normality in these organs when the tests were taken. In the radiographic studies of abdominal cramps, the X-rays of the intestinal tract showed that the normally small amount of gas present expands greatly at altitudes of 35,000 ft., when it is equivalent to a four-fold expansion of original volume. Kelley-Koett Manufacturing Company, Covington, Ky.

Aircraft Fire Extinguisher

A portable carbon-dioxide fire extinguisher, made of high-pressure, lightweight steel, is being produced for use on military aircraft.

Equipped with a pistol grip so that it can be easily operated with one hand, this extinguisher contains 2 lbs. of carbon dioxide compressed into liquefied form at 850 lbs. per sq.in. at a temperature of 70°F. Since penetration of the cylinder by a bullet or bit of flak would cause it to explode, the cylinder is subjected to a shatter-proofing process. Walter Kidde & Company, Inc., New York.

Control of Fire

Flame Facts, a 20-min., 6-mm. sound motion picture in Kodachrome, has been issued as part of an educational campaign on the nature and control of fire. The film demonstrates how and why fire burns, the different kinds of fires and how they should be tackled, and the correct use of different types of extinguishers. Common errors in first aid fire fighting are shown and tips on fire prevention are given. The picture was planned primarily for use by plant executives, foremen, fire-fighting units, and educational groups. Walter Kidde & Company, Inc., New York.

Variable-Pitch Fan

Changes in the design of an automatic variable-pitch fan for the temperature control of aircraft engines have resulted in a more compact assembly. In the improved model the controlling thermal element is direct-connected through the fan spindle to the blade-turning mechanism. Earlier models were provided with separately attached thermal units, and the fan blades were rotated by means of outside linkage. The change has brought no alteration in the basic principles of operation. This entirely automatic variable-pitch fan continues to be actuated by a thermostatic element directly controlled by the temperature of by-passed engine jacket water. The fan blades feather from practically zero to as much as 38° pitch and are stated to hold engine temperatures within safe, narrow ranges under all load and climate conditions. Kontrol Fan Inc., Los Angeles.

Combustion Tube Furnace for the Laboratory

The CF-1, a single-tube furnace, is designed for the fast and modern method of carbon and sulphur determinations, as well as gravimetric determination of carbon and all alloy steels, including stainless and heat-resisting steels. Temperatures obtainable for continuous operation are up to 2,500°F., while for occasional operations temperatures of

P-38 TEAM

PLANE, PILOT, GROUND CREW—IT TAKES ALL THREE TO WIN A FIGHT!

You've heard plenty about P-38's and the pilots who fly them. But under the tough conditions of modern war, they wouldn't be flying long without the third part of the team—the ground crew. The men who keep Lightnings in action are specialists. They've been trained at the factory, not just to repair *airplanes*, but to repair *Lightnings*. At Lockheed's service school they have taken them apart and rebuilt them. They have put in new hydraulic and fuel systems, new wiring and controls. They have learned to make emergency repairs—like fixing a riddled gas tank with tin cans and scraps of rubber. They know how to get a plane back into the air and *keep* it there.

Lockheed is the first aircraft manufacturer to operate a factory training school for ground force personnel. It has turned out to be a mighty valuable operation, for today there are over 14,000 Lockheed trained men scattered throughout the world servicing P-38's, Venturas and other fighting planes.

Yes, it takes plane, pilot and ground crew—all three—to make a fighting team. The news reports are telling you better than we can what an expert job they're doing.

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The best proof of what a company *can* do is what it *has done*. Unfortunately, however, military prudence dictates that we can't talk very much — specifically — about the relative ease with which we have accomplished what many ordnance centers regarded as almost impossible jobs of precision and accuracy. So, for now, we'll have to ask you to take our word that we are highly skilled specialists in quantity production of — **All Types of Authenticating GAGES • JIGS • FIXTURES • MOLDS • FORM TOOLS.** We turn out these vital products, and small precision parts, as well, in one of the most efficient, most flexible, and best equipped shops of its kind in the country. The precision and accuracy of our work cannot be excelled. . . . . .

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up to 2,650°F. are permissible. High-temperature Globar elements are easily installed or removed without total dismantling and assembling of the unit.

All necessary control is conveniently located on the face of the furnace. Temperature regulation is provided by coarse and fine adjustment knobs connected to a built-in variable-voltage transformer. An ammeter shows the proper and safe current required for the Globar heating elements, while temperature is indicated by a pyrometer, which is connected to a platinum thermocouple. A knob for controlling the flow of oxygen operates a needle valve connected to rubber tubing adapters located at both ends of the housing for convenient piping to the oxygen supply. A line cutoff switch and a signal light that shows when the furnace is operating are both included with the control.

These units are equipped with three adapters for interchangeability of standard combustion tubes, 1, $1^1/_4$, and $1^1/_2$ in. outside diameter. A fourth tube, 2 in. outside diameter, can be used without an adapter. Furnaces are built for operation using 60-cycle alternating current at 110 or 220 volts. Units to operate at 25-cycle frequency can also be supplied. Lindberg Engineering Company, Chicago.

Lockheed and Vega Merged

Effective November 30, 1943, the Vega Aircraft Corporation became an integral part of the Lockheed Aircraft Corporation and the name "Vega" disappeared from the corporate identity of the greater Lockheed company. Vega has been a wholly-owned subsidiary of Lockheed for two years, and the merger was merely a compacting of two organizations into one—a continuation of the trend toward closer cooperation between two allied organizations.

Lockheed Aircraft Corporation is headed, as before, by President Robert E. Gross, who also was Chairman of the Board at Vega. Courtlandt S. Gross, former Vega President, became Vice-President in Charge of Sales and Service; Cyril Chappellet is Vice-President in Charge of Administration; Mac Short, Vice-President in Charge of Engineering for Lockheed A-Plants (the former Vega plants); Hall L. Hibbard, Vice-President and Chief Engineer for Lockheed B-Plants (the former Lockheed plants); H. E. Ryker, Vice-President in Charge of Matériel; and C. A. Barker, Vice-President in Charge of Finance, and Treasurer. Other officers of Lockheed are L. W. Wulfekuhler, Secretary; Dudley E. Browne, Comptroller; and H. R. Campbell and Ron P. King, Assistant Treasurers. Lockheed Aircraft Corporation.

Navigator's Protractor

A navigator's protractor has been designed for computing variations and deviations in about 30 sec. This protractor is used to convert the true course to the magnetic course. It enables the navigator to determine the gyro and compass course at the same instant. It also may be used to determine position with the use of a radio direction-finder station. Moore Engineering Company, Portland, Ore.

Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assumed by the Aeronautical Engineering Review.

Air Booster Pump

By adding a hydraulic air booster to a combination fluid and air pumping unit, an air pressure of 1,500 lbs. is obtained for use in recharging aircraft struts. The pressure may be controlled by the operator from any point up to maximum delivery, and it is stated the booster has been so engineered that it will reach top pressure very quickly. Pacific Airmotive Division, Airplane Manufacturing & Supply Corporation, Glendale, Calif.

Portable Power Unit for Field Service

A portable power unit has been developed for use under field conditions where power must be brought to aircraft lines at a considerable distance from regular power lines. Assembled on a rubber-tired truck chassis, this unit consists of a 4-hp. gasoline engine and a 50-amp., 30-volt shunt-wound generator together with suitable accessories. The unit has the capacity required to start airplane engines, to check and test radio equipment and gun turret systems, and to recharge storage batteries while installed. Pacific Airmotive Division, Airplane Manufacturing & Supply Corporation, Glendale, Calif.

Sea Water Desalter

A chemical that takes the salt out of sea water in 20 min. and permits a flier to carry the makings of a 14-day supply of drinking water in his rubber life raft has been reported as recommended by the Naval Medical Research Institute and is now in production, climaxing more than a year of research in which numerous desalting devices have been invented and tested. The new chemical "desalter," which converts over 14 pints of sea water into drinking water, is carried in the form of briquets the size of a small candy bar. When dropped into a plastic bag filled with seawater, the chemical quickly absorbs the dissolved salts, permitting them to be filtered out as the flier sucks the water through a plastic tube. Each briquet weighs only one-sixth as much as the drinking water it produces and takes up only one-tenth as much space. The Permutit Company, New York.

New Slide Rules

Three new slide rules—one for the professional draftsman, one for the apprentice draftsman or student, and a handy 5-in. pocket slide rule—have been made available.

All three of the rules contain the scales A, B, C, D, CI, K, S, L, and T. With the exception of the apprentice rule, they are celluloid-faced. The apprentice rule has a painted face. These rules are provided with a case and instruction sheet on the operation of the slide rule. Frederick Post Company, Chicago.

"Water Injection" for Emergency Power

Auxiliary equipment in the form of a water-injection device installed on 2,000-hp. Pratt & Whitney Double-Wasp engines powering P-47 and certain Navy fighters provides bursts of added emergency power. The equipment, which until recently has been a military secret, is designed to provide the added surge of power needed to increase the climb or speed of a fighter in an emergency, such as to gain position on an adversary or take successful evasive action not possible under ordinary conditions of operation. It is stated that its effectiveness has already been proved in actual combat.

Three advantages of the water-injection device are stated to be: (1) The cooling effect of the vaporization in the cylinder is greater with water than with fuel; (2) the susceptibility to detonation, which limits the power that can be taken from a cylinder, is lessened with the presence of water in the cylinder; and (3) it produces more power because it permits the use of a leaner mixture from the carburetor. Pratt & Whitney Aircraft Division, United Aircraft Corporation.

New Resins

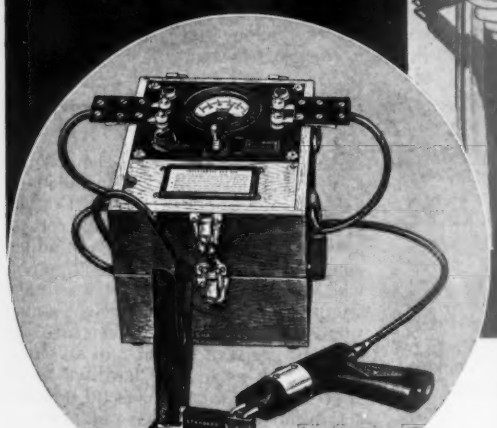
Two new resins have been developed which are stated to be especially valuable for use in the manufacture of oleoresinous varnishes and enamels containing all or preponderant amounts of the soft oils.

Amberol F-77, a phenolic type, has been introduced as a modification of Amberol F-7. It is stated to be more soluble in bodied oils and to impart higher viscosity, better drying properties, and improved alkali and water resistance to varnishes and enamels of all types and oil lengths.

Amberol 808, a high viscosity resin of the maleic type, is intended primarily for use in those applications where its pale color and good color retention will be particularly advantageous. This grade is said to represent an improvement over Amberol 806-P in bodied oil solubility, petroleum tolerance, drying properties, and alkali

New! LOW-RESISTANCE TEST SETS

(BOND TESTERS)



The modern way to test bond or contact resistance down to 0.0001 ohm.

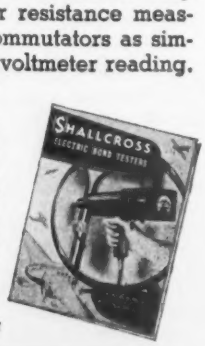
Fast – Accurate – Easy to Use

The new Shallcross Low-Resistance Test Sets, Types 645 (Army range) and 653 (Navy range), include all of the features of the Shallcross Milliohmmeter and Aero Gun Models while providing greater portability, ease and speed of operation.

The Tester itself is supported conveniently in front of the operator by means of adjustable shoulder straps. Measurements as low as .0001 ohm are made, simply by attaching the fixed clamp to one side of the bonded surface, and touching the hardened points of the Pistol Grip Exploring Probe to the other side. The weight of the Pistol Grip Exploring Probe is reduced to a minimum by incorporating the meters, batteries, etc. in the suspended Tester cabinet.

In addition to their widespread use in testing aircraft bonding, these Shallcross Test Sets are unexcelled for testing railroad bonds, radio equipment, contact resistance of relays, circuit breakers, switches, and various others. They make bar-to-bar resistance measurements on commutators as simple as taking a voltmeter reading.

The two new models are similar, except that Type 645 (Army range) is 0.005 and 0.5 full scale, whereas Type 643 (Navy Range) is 0.003 and 0.3 ohms full scale.



WRITE FOR "BOND TESTER" CATALOG

A copy of the Shallcross Low-Resistance Test Set Catalog describing these and other Shallcross models in full detail will gladly be sent on request. Write for Catalog

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High-Speed Balancing Machine

The "Electrodynascope" is reported to differ from conventional high-speed balancing machines in that it directly measures the added alternating bearing forces exerted by the unbalance of the rotor rather than tangible displacement of balancing parts.

Alternating unbalance forces are transmitted by a practically rigid platform to quartz crystals producing piezo-electric potentials that are magnified by vacuum-tube amplifiers and made visible on the screen of a cathode-ray oscillograph. The magnitude of the unbalance ultimately expressed in ounce-inches or depth of drilled or milled holes is indicated as a sine wave pattern, representing magnitude and location of unbalance.

Since centrifugal forces are measured instead of displacements caused by such forces, and, since the rotor is mounted on rigid supports having a natural frequency considerably above the balancing speed, inertia forces are negligible and indications are independent of the weight of the rotor. Standard models up to the 75-lb. rotor weight for speeds up to 12,000 r.p.m. are available. Sonntag Scientific Corporation, Greenwich, Conn.

High-Altitude Aircraft Heater

A new type of gasoline heater which operates on the surface combustion principle has been developed for airplanes operating at high altitudes. The heater is particularly intended for purposes such as cockpit heating; defogging and deicing aircraft windshields and windows; and preventing ice forming on wings, empennage surfaces, instruments, and other equipment. It is stated that it can be lighted and will function at any temperature down to −70°F. and has been operated at a simulated altitude of 57,000 ft.

The heater operates on the principle of burning a vaporized or atomized fuel in the center of a column of spinning air. The whirling action of the combustion air is produced by introducing the air tangentially into a cylindric combustion tube.

The liquid fuel enters the combustion tube through a vaporizer or spray nozzle ahead of the combustion air inlet. This vaporized or atomized fuel is mixed with the spinning column of air, forming a long, tapering core of enriched gases completely surrounded by the whirling air column. The combustion process is thus prolonged or delayed for maximum efficiency and heat liberation throughout the full length of the combustion tube. Since the fuel and air are mixed within the heater, its operation is independent of additional mechanical devices.

It is stated that the annulus or blanket of hot combustion air which surrounds the flame core not only provides an adequate supply of oxygen

This surface combustion "Janitrol" aircraft heater weighs only 6 lbs.

but scrubs the inside surface of the combustion tube and prevents direct flame impingement on the inner metal surface. At the same time it minimizes the accumulation of carbon, lead salts, or any other combustion products on heating surfaces.

In this heater it is stated that combustion is maintained with variations in the proportion of combustion air of from 65 to 800 per cent of the theoretic requirement. A catalogue has been issued describing the heater and the principle on which it operates. Surface Combustion Division, General Properties Company, Inc., Toledo, O.

Chart Adapters and Fixtures

New chart holding adapters which make possible the use of translucent engineers' glass and engineers' transparency charts on the Bausch & Lomb contour measuring projector have been made available. With these chart holders, charts of various sizes are held firmly in the correct position yet can be easily interchanged. The holders are made of seasoned mahogany.

An engineers' glass and transparency holding fixture for use on Jones & Lamson comparators has also been developed. With this fixture, charts and layouts can be easily adjusted and then held in the desired position. Universal Engineering & Colorplate Company, Buffalo.

Roll Thread Snap Gauge

Snap gauges with John-Sons rolls have been added to the maker's established line of gauge products. The design is such that it will check both right- and left-hand threads.

The improved snap gauge frame that has been used to hold these new John-Sons rolls has a special grip molded to hand contours and wide machine pads for bench-stand setups and is made of a special grade high-strength cast iron with low reaction to temperature changes.

Like all Vard roll-thread snap gauges, this new one is a combined "Go" and "No Go" inspection instrument for rapidly checking male threads to both maximum and minimum limits in one operation. It checks such conditions in the thread as pitch diameter, thread angle, and lead.

Vard John-Sons roll-thread snap gauge is offered in sizes ranging from numbered series up to and including 12 in. and may be obtained in National, Metric, Acme, Whitworth, and other special thread forms. Vard, Inc., Pasadena, Calif.

Bomb Fuzes Tested in Wind Tunnel

A three-foot long wind tunnel that creates 300 to 800 m.p.h. gales to simulate the wind currents encountered by falling bombs has been developed by Westinghouse engineers to test fuzes for 20-lb. fragmentation bombs.

These bombs are equipped with safety fuzes. By timing the release of a firing pin during descent of the bomb, the fuze prevents premature explosion. When an American plane unloads a "stick" of fragmentation bombs, the fuze on the bomb must prevent detonation until the bomb is safely away from the plane. Only when the bow-tie-like vane on the tip of the fuze has revolved a predetermined number of times will the bomb be ready to explode on impact. Revolving of the vane loosens a safety device that in turn releases the firing pin to strike explosive portions of the bomb when it hits the ground. Unless the fuze releases the firing pin, the bomb will be a dud.

To maintain a constant check on the quality of fuzes produced, a certain number are taken each day from the final assembly line and tested in the wind tunnel. Their performance is measured by the speed in "arming" or releasing the safety devices. To pass the wind-tunnel test, a fuze synthetically "dropped" at 250, 500, and 800 m.p.h. must arm within a predetermined length of time.

Before introduction of wind-tunnel tests, specifications called for testing at simulated airplane speeds of 75 m.p.h. This was done by mechanically spinning the vane. The slow speed was not close enough to actual operation to reveal functional defects.

Early wind-tunnel tests pointed the way to a redesign of the fuze which drastically reduced failure to detonate. An additional gain in the design revision was the substitution of steel for aluminum, saving 22,800 lbs. of aluminum each month. Since production started on the new fuze, it is stated that not a single fuze has failed to meet the test.

To test a fuze, a laboratory technician places the fuze inside the narrow 3-ft.-long tunnel so that it will be in the path of compressed air to be fired from a cylindric tank. Then the technician presses a button that starts an automatic timer and opens a magnetic valve. As the valve opens, a burst of air rushes from the tank through a reducing nozzle to the fuze, whirls its vane, and releases the safety device. As the safety device flies off, it permits a beam of light to strike a photoelectric cell. This causes the photoelectric cell electronically to close the valve and stop the timer. Speed of the wind created for each test is determined by measuring the change in the tank's pressure and the time that the valve is open.

"Arming" time of each fuze is measured by the automatic timer in intervals as small as $^1/_{120}$ sec. Westinghouse Electric & Manufacturing Company.

22-Foot "Stratosphere" Firing Range to Test Aircraft Cannon

At Eglin Field, Florida, Army Air Forces proving ground, a refrigerated firing range only 22 ft. long is being built to test the effectiveness of large-caliber aircraft cannon in a man-made stratosphere at −70°F.

The Vard roll thread snap gauge.

CHIKSAN

Ball Bearing HYDRAULIC SWIVELS for AIRCRAFT

The trend toward larger, heavier, more powerful aircraft demands equipment which provides for safe, dependable operation under the most severe conditions. Wherever hydraulic control lines, brake lines and oxygen lines must rotate or move, CHIKSAN Ball-Bearing Swivels provide complete flexibility with dependable safety, and with minimum of maintenance service.

CHIKSAN Ball-Bearing Hydraulic Swivels are built to AN Specifications and are custom-built to each individual manufacturer's designs. They are supplied with either AN or other special end connections, as well as with standard threaded ends, flanged ends or bored for welding.

LIGHT WEIGHT: Envelopes are made from aluminum alloys, steel or other materials suitable to the purpose for which they are to be used.

LOW TORQUE: Ball bearings of proportionate size and capacity assure easy turning with minimum torque at high or low temperatures and high or low pressures.

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BALL BEARING SWING JOINTS for ALL PURPOSES

BREA, CALIFORNIA

The firing range will consist of twin steel vacuum chambers where temperature and air pressure will duplicate the stratosphere 9 miles above the earth. In this atmosphere, shells will leave the muzzle of the guns, travel the length of the 22-ft. range, and dig into a backstop containing 20 tons of sand with the force of approximately 3,600,000 ft. lbs. of energy. The purpose of the equipment is to study the effect that lack of oxygen and sub-zero weather have on the detonation and the speed of projectiles. With this application of the stratosphere chamber, engineers can study at close range conditions that ordinarily could be observed only in actual combat, such as the effects of a 140°F. change in temperature and of a sharp drop of atmospheric pressure on the gun mechanism and on the flight of the projectiles. The effect of low moisture content on delicate firing mechanisms and the greater concussion produced by big guns in rarefied air are among other questions that can now be studied.

Two steel cylinders and a concrete sand trap will make up the stratosphere firing range, the whole covering a distance of only 50 ft. The first compartment will be a stratosphere chamber similar to that used to test pilots and plane equipment. In it will be mounted the gun to be tested, with its barrel projecting forward through the front end of the chamber and into a concussion chamber. With the muzzle of the gun just projecting into the concussion chamber, the shells will be fired across the 22-ft. space and into another porthole at the forward end of the chamber. In back of this porthole will be the sand trap chamber of reinforced concrete with its backstop of 20 tons of sand. At the present time, the shortest known range for heavy-caliber guns is 300 ft.

Two men equipped with oxygen masks will enter the main strato-chamber to operate the guns. For each maximum test, temperature will be dropped from +70° to −70°F. in 12 min. while air pressure is reduced to a partial vacuum of 2.2 lbs. per sq.in. In the concussion chamber into which the muzzles of the guns project, temperature will be maintained at −67°F. In this chamber, cylindric steel walls must be constructed to absorb the shock of a concussion-bursting pressure of 100 lbs. per sq.in. of surface.

A period of 12 hours is required to prepare both the main strato-chamber and the concussion chamber for 1 hour of testing. During this time, the refrigerant is circulated through coils in the upper portion of the chambers until the temperature drops below −70°F. Just before each test, this frigid air in the chambers will be warmed quickly by electric heaters to a normal 70°F. to simulate the start of a stratosphere flight. When the chambers are loaded and sealed, the warm air will be withdrawn and cold air, together with the refrigeration built up in the walls, will drop the temperature back to −70°F. in 12 min. York Corporation, York, Pa.

The 2 strong, tough alloys, "K" Monel and "KR" Monel, are non-magnetic down to 150° F. below—

Unusual characteristics of these two alloys increase their range of usefulness

Well-known properties of age-hardenable "K" and "KR" Monel are strength and hardness equal to that of some heat-treated alloy steels. Lesser known but also important are two other characteristics exhibited by these metals:

1. "K" and "KR" Monel remain non-magnetic in all conditions, at temperatures far below those encountered in actual service.
2. "K" and "KR" Monel retain room temperature, ductility and toughness at sub-zero temperatures.

Magnetic Permeability and Curie Point of "K" MONEL and "KR" MONEL

Condition	Permeability at room temperature H=200 oersteds (air=1.02 max.)	Magnetic Transformation Temperature (permeability of 1.02° F.)
Soft (quenched)	1.001	—200
Quench and age-hardened	1.002	—150
Cold-drawn	1.001	—200
Cold-drawn and age-hardened	1.002	—150

For these reasons, in addition to their usual applications, "K" and "KR" Monel are used where magnetic disturbances must be avoided or eddy currents minimized . . . as in magnetic surveying equipment and important applications in aircraft structures and instruments.

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MATERIAL	CONDITION	Temperature °F.	Yield Strength (0.20% offset) psi.	Tensile Strength psi.	Elongation in 2 in. per cent	Reduction of Area per cent	Hardness Rockwell C	Charpy impact Strength ft.—lb.
"K" MONEL	Cold-drawn age-hardened	Room	125,900	157,300	15.5	37.4	33	27
	Cold-drawn age-hardened	—110	134,600	171,550	17.3	41.1	36	27

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Institute News

The Seventh Wright Brothers Lecture

Commemorating the 40th anniversary of the flights of the Wright Brothers at Kitty Hawk, N.C., on December 17, 1903, William Scott Farren, Director of the Royal Aircraft Establishment of England, presented the Seventh Wright Brothers Lecture of the Institute on December 17 before 600 members and guests of the Institute in the U.S. Chamber of Commerce Auditorium, Washington, D.C. The subject of the Lecture was "Research for Aeronautics —Its Planning and Application."

Dr. Hugh L. Dryden, President of the Institute, acted as chairman of the meeting and discussed Mr. Farren's paper. Other discussers were Dr. J. C. Hunsaker, Head of the Department of Mechanical Engineering and Department of Aeronautical Engineering, Massachusetts Institute of Technology; Dr. George W. Lewis, Director of Aeronautical Research, National Advisory Committee for Aeronautics; Dr. Th. von Kármán, Director, Daniel Guggenheim Graduate School of Aeronautics, California Institute of Technology; and Dr. E. P. Warner, Vice-Chairman, Civil Aeronautics Board. The complete Lecture and the discussions will be published in full in the April issue of the JOURNAL OF THE AERONAUTICAL SCIENCES.

Mr. Farren summarized his experience in flight research during the past 30 years and emphasized the need for close cooperation between the scientist, designer, and user. In surveying the 25 years of achievement of the Royal Aircraft Factory (now the Royal Aircraft Establishment), he gave examples of the advances made by comparisons between the World War I S.E.5 fighter and the Spitfire, and the Handley Page twin-engined heavy bomber of World War I and the Lancaster. He said:

"The Spitfire has the same wing surface as the S.E.5, about half the drag, nearly twice the strength, three times the speed, four times the total weight, four times the military load, and seven times the power. The Lancaster has about half the drag of the Handley Page 0/400 on the same span of wings and about three-quarters the wing surface. Its total weight is nearly five times as great; the wing loading, over six times; the power, seven times; and the military load, with a 25 per cent greater range, over eight times."

Advances in power-plant design, in structures, and in stability and control were also surveyed.

W. S. Farren.

The value of the independent worker was particularly stressed, and Mr. Farren expressed the hope that "One day we shall learn to trust our scientific advisers with a reasonable fraction of our money on a block-grant basis and ask no account except at longish intervals."

Mr. Farren was graduated with honors in Mathematics in 1912 and with honors in Mechanical Sciences in 1914 from Cambridge University, England. In 1915 he joined the Royal Aircraft Factory (now the Royal Aircraft Establishment) and was in charge of flight and laboratory experiments in aerodynamics and aerodynamic design.

From 1918 to 1930 he was associated with Armstrong Siddeley Motors in Experimental work in connection with airplane design. He returned to the Engineering Department of Cambridge University in 1921 and later became a Fellow and Lecturer of Trinity College and University Lecturer in Aeronautics. In 1937 he became Deputy Director of Scientific Research in the Air Ministry; in 1939, Deputy Director of Research and Development (Aircraft); and in 1940, Director of Technical Development, Ministry of Aircraft Production. This position was retained until he became again associated with the Royal Aircraft Establishment as Director in July, 1941.

Since 1918 Mr. Farren has been connected with the Aeronautical Research Committee, first as a member of various subcommittees and in 1933–1934 as a Member of the Committee. He has published many scientific articles in technical aeronautical journals, was awarded the Simms Gold Medal for 1935 of The Royal Aeronautical Society for his contributions to new methods of measurement of drag and his designs of scientific apparatus for aeronautical research, and was also the recipient of the Society's Edward Busk Memorial Prize for 1929 for his paper "Monoplane or Biplane?" presented before the Society.

He is a Fellow of the Institute of the Aeronautical Sciences and of The Royal Aeronautical Society of Great Britain.

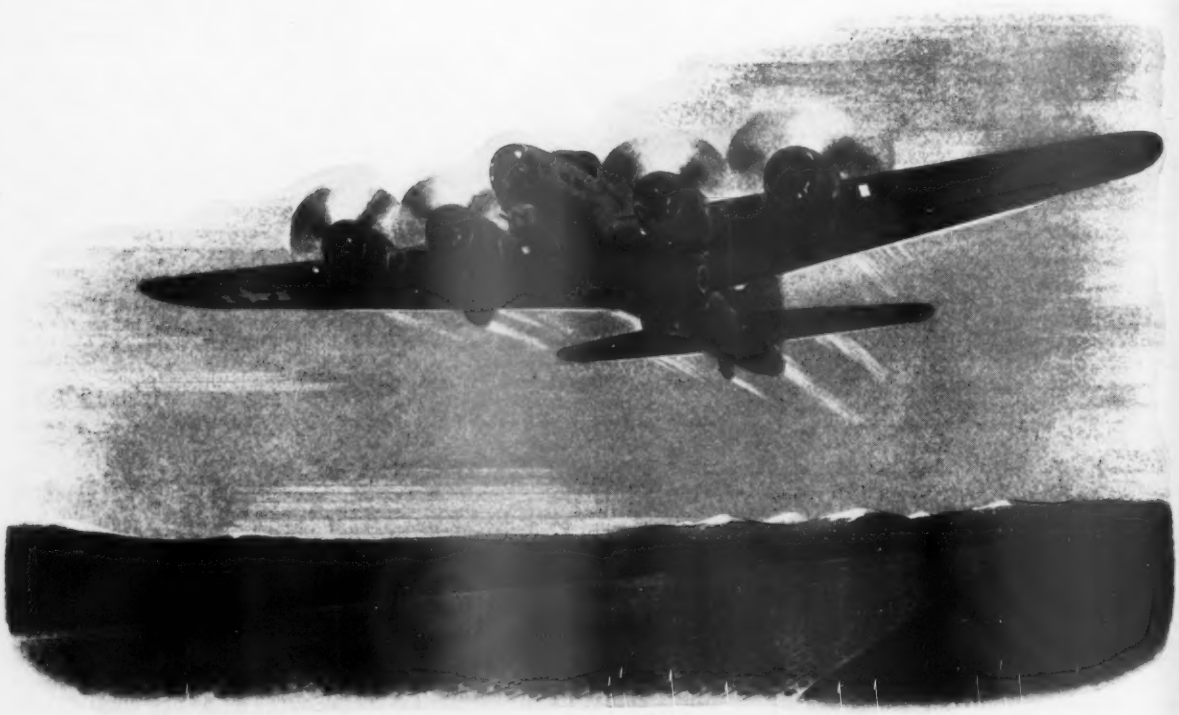
Among those who attended the Lecture were: Orville Wright; Sir Richard Fairey, Director General, British Air Commission; Air Vice Marshal R. B. Mansell, British Air Commission; T. P. Wright, Director, Aircraft Resources Control Office, Aircraft Division, W.P.B.; Adm. Emory Land, Rear Admiral (Ret.), U.S.N.; Chairman, U.S. Maritime Commission; Henry J. E. Reid, Engineer in Charge, Langley Memorial Aeronautical Laboratory, N.A.C.A.; Major Gen. O. P. Echols, U.S. Assistant Chief of Air Staff for Matériel, Maintenance, and Distribution, Army Air Forces; Rear Adm. D. C. Ramsey,

Additional Paper Cut

The War Production Board has advised the magazine publishing industry that an additional paper cut will be necessary, effective Jan. 1, 1944.

To insure the service of members with the JOURNAL OF THE AERONAUTICAL SCIENCES and the AERONAUTICAL ENGINEERING REVIEW during 1944, the Institute has discontinued the acceptance of any new subscriptions outside the membership of the Institute.

Landing Gear and Turrets Equipped with WINTERIZED BARCO FLEXIBLE JOINTS



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Sylvanus Albert Reed Award for 1943 to Dr. S. A. Moss

The Sylvanus Albert Reed Award for 1943, conferred annually by the Institute of the Aeronautical Sciences in recognition of a notable contribution to Aeronautical Engineering, will be presented to Dr. Sanford A. Moss, General Electric Engineer, "for development of the turbosupercharger which has made possible the high altitude operation of aircraft." The award will be presented at the Honors Night Dinner of the Institute in New York on January 24.

Dr. Moss is a graduate of the University of California. Following employment as a draftsman on internal-combustion engines and steam turbines with General Electric, he attended Cornell University as a graduate student and instructor. After receiving the degree of Doctor of Philosophy in 1903, he returned to General Electric. He continued his work on gas turbines, centrifugal compressors, and exhaust-driven superchargers and was in charge of the last from World War I to the time of his retirement in 1938. In 1941 he voluntarily resumed his work as a consultant engineer for General Electric for further development on turbosuperchargers.

He received the 1940 Collier Aviation Trophy jointly with the Army Air Forces "for outstanding success in high altitude flying by the development of the turbosupercharger." Dr. Moss also received one of General Electric's Coffin Awards for his supercharger work. He was given an Honorary Degree of Doctor of Laws by the University of California in 1943.

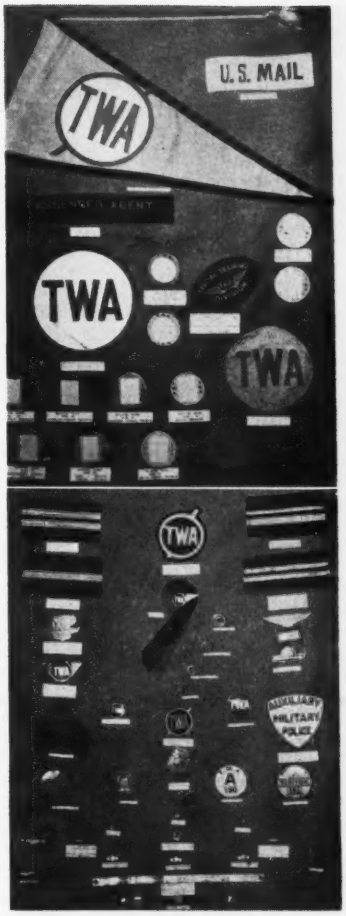
The Sylvanus Albert Reed Award was endowed in 1933 through a bequest of $10,000 by the late Dr. S. A. Reed and is given annually for outstanding achievements in the aeronautical sciences.

Dr. Sanford A. Moss.

Gifts to the Aeronautical Archives

William S. Henson's personal copy of *A System of Aeronautics*, by John Wise, Philadelphia, 1850, was added by Mr. and Mrs. George W. Lipsham and Miss Winifred Lipsham, of Orange, N. J., to their previous gift of Henson books and papers through S. Paul Johnston. This copy contains marginal notes by Henson and is an unusual addition to the Americana collection of the Aeronautical Archives.

Two photographic negatives, on glass, of Wilbur and Orville Wright, taken by Hollander in 1907, and a framed photograph of a double profile of the brothers were received from Orville Wright as a gift of Mrs. C. G. Price of St. Petersburg, Fla.



TWA Gift Insignia.

A collection of breast and cap insignia of the Royal Air Force, Royal New Zealand Air Force, Royal Australian Air Force, and Royal Canadian Air Force was received through Brig. Gen. Robert W. Harper of the Air Staff in Washington. The Curtiss-Wright Corporation in Buffalo, through Frederic Flader, sent a collection of identification badges and passes used at the plant there. Three insignia of Alaska Star Airlines were received from C. O. Cary. The Brazilian Air Force sent its cap and breast insignia, which were not previously represented in the collection. Mrs. Bella C. Landauer gave a button showing a Glenn H. Curtiss airplane in flight. Herbert Young, of the New York Public Library, gave an R.A.F. lapel pin.

A model of a fighter plane bearing the signatures of C. L. Chennault and May-ling Sung Chiang on opposite wings, especially signed for the Institute, was received from Prof. F. M. N. Brown of Notre Dame University, who recently returned from China.

The Texas Company, through M. P. Doss, gave 15 volumes of its magazine, *Lubrication*. The Ryan Aeronautical Institute gave a copy of its textbook on *Airplane Stress Analysis*, revised edition, in twelve volumes, published in 1942.

The collection of U.S. Army Air Force post papers was increased by 85 new papers received during the last month, making a total of about 100 of these received to date.

Sets of *Army Air Forces Standards*, *Army-Navy Aeronautical Specifications*, and *National Aircraft Standards* were received from the Specification Branch of the Matériel Command at Wright Field. Other donors of books and pamphlets included American Airlines; the American Meteorological Society; American Society for Testing Materials; Barber-Greene Company; Prof. W. J. Cunningham, of Harvard University; Camp Lee, Va.; Curtiss-Wright Corporation; Mrs. Bella C. Landauer; The Joseph F. Lincoln Arc Welding Foundation; Los Angeles County Schools; New York Public Library; New York Telephone Company; New Jersey State Teachers College, Upper Montclair; Patterson Field, O.; Pennsylvania Department of Public Instruction; C. P. Seitz; Selman Field, La.; Sweet's Catalog Service; Utah State Board for Vocational Education; University of the State of New York; U.S. Engineer Office; and the U.S. Navy Hydrographic Office.

New Corporate Members

Associated Foundries & Manufacturers, Inc., specializes primarily in hydraulic equipment for aircraft. Among the items in production are hand pumps, timing valves, shrinkage struts, hydraulic cylinders for gun turrets, and selector valves. Recently, production has been extended to include various gear assemblies for gun turrets.

Equipment produced by the company is used by Republic Aviation in the Thunderbolt fighter planes and by Engineering & Research Corporation of Riverdale, Md.

Hanna Engineering Works was established in 1901 and the business was incorporated in 1903. The company manufactures pneumatic and hydraulic apparatus and equipment, hydraulic controls and assemblies, machine tools, and portable tools.

Its present activity in the aeronautical field is principally in supplying pneumatic and hydraulic riveters, cylinders, and valves for use in plant production processes.

Link Aviation Devices, Inc., are designers and manufacturers of products used by the Army Air Forces, U.S. Navy, Royal Air Force, and commercial air lines. The company is a pioneer in the development of synthetic training equipment for members of flight crews.

Among the products of the company, all of which are original and innovative in their design and application, are instrument and radio pilot trainers, celestial navigation trainers, bombing trainers, pilotage navigation trainers, automatic pilot trainers, preflight trainers, sextants, collimators, etc.

The company has under development at the present time a variety of products having both war and peacetime application.

Sections and Branches

Seattle Section

At a meeting of the Seattle Section held on November 3, 1943, the speakers were T. E. Gamlem and R. L. Stith of the Engineering Division of Boeing Aircraft Company.

Mr. Gamlem discussed his experiences as a service engineer in England, and Mr. Stith told of his activities in a similar capacity in the South Pacific. Both speakers also discussed the characteristics of various Allied and Axis aircraft with which they had come into contact. The attendance was 306.

Aeronautical University

At a meeting on October 12 a Program Committee consisting of Messrs. Lawrence Vlastnik, Howard Swartz, Harold Ellingsen, Louis F. Beller, and Gus S. Papas was appointed. The committee will make a special effort to secure motion-picture films on aeronautics. A special meeting was held on November 2 in this connection.

The following films loaned by the Office of War Information were shown on November 4: *Our Enemy—The Japanese*, *The B-17*, and *The Jap Zero*. The entire student body was invited, and the response indicated that a satisfactory source for films has been obtained.

At the regular meeting on November 9, future debates were discussed, and the subjects were "Liquid-Cooled versus Air-Cooled Engines," "The Heavy Versus the Medium Bomber," and "The Light Sport Plane Versus the Helicopter." For the first debate, Messrs. Howard Swartz, Lawrence Vlastnik, and Harold Ellingsen will speak for air-cooled engines, and Nathan Horwitz, Eugene Peterson, and Gus Papas will uphold liquid-cooled engines.

Because of the acceptance of another position elsewhere, Mr. Stabley has yielded his office as Honorary Chairman to Mr. Joseph Gorman.

University of Cincinnati

The first fall meeting was held on October 28, the unanimous decision being made to continue the activities of the Student Branch as long as possible. The following officers were elected: Chairman, L. E. Terry; Vice-Chairman, C. S. Doherty; Secretary, D. K. Paxon; Treasurer, R. J. Fritz. The honorary Faculty Chairman is Bradley Jones, and the Faculty Representative is H. P. Liepman.

It was decided to hold meetings every other week and to invite the students of the Goodyear Aircraft Junior Engineering Program, a group of 30 selected girls taking a 6 months' course in Aeronautical Engineering.

The second meeting, held on November 4, was featured by a talk by C. S. Doherty on the history and development of the helicopter.

At the third meeting, on November 18, R. J. Fritz gave a biographic talk on William B. Stout. The meeting was closed with decision to continue these meetings in March, 1944, when this group returns to college.

Illinois Institute of Technology

A farewell party was given on October 13 for Dr. Hans Reissner who left the Institute to become Professor of Aerodynamics and Aeronautical Structures at the Polytechnic Institute of Brooklyn. A pen and pencil set was given to him as a farewell token. On November 16 the following officers were elected: Chairman, John Sluis; Vice-Chairman, Herbert Miller; Secretary and Treasurer, Norman W. Carey.

Iowa State College

A review of the activities of the Iowa State College Branch for 1943 indicates that during the spring quarter only three business meetings were held, mainly for the purpose of electing officers to fill the vacancies left by men called to the armed services Merle Evers succeeded Graydon Peoples as Senior Representative to the Engineering Council and took over the duties of Chairman when Robert Caswell was inducted into the Navy. Edward Eales replaced Warren Hayes as the Junior Representative, and Paul Burke was elected Treasurer to replace James McCoy.

During the spring quarter a mimeographed paper, called *The Flypaper*, edited by Graydon Peoples, was used to announce meetings, but its publication was discontinued upon induction of the editor into the Army.

Activity was suspended during the summer with the exception of one meeting held on July 16, at which a demonstration was given of the Wright Cyclone Engine. A full-size sectioned engine was demonstrated by R. E. Perkey, a representative of the Studebaker Corporation of South Bend, Ind.

The next meeting was held November 11. H. W. Case of Douglas Aircraft Company spoke on engineering practice at the El Segundo plant of Douglas and showed two films: *Design for Flying*,

showing the steps in the design of a typical airplane, and *We Give Them Wings*, the story of the production of a plane.

A meeting on December 1 resulted in the election of the following officers: Chairman, Edward Eales; Vice-Chairman, Al Eggers; Program Chairman, Robert Johnson; Secretary, Leonard Margules; Treasurer, Harry Thomsen; Junior Representative to the Engineering Council, Ralph Newcomer. A film, *Identification of the Jap Zero Fighter*, was shown, and arrangements were made to have a group photograph taken for insertion in the college yearbook, *The Bomber*.

North Carolina State College

Initiation of new members was held on November 9, when 12 new members and 17 associate members were inducted.

The last meeting for the term took place on November 30, when Wesley J. Hennessy of the Grumman Aircraft Engineering Corporation was the guest speaker.

Purdue University

At a business meeting on November 23 the following officers were elected: Chairman, H. H. Johnsen; Vice-Chairman, Robert Gwinn; Secretary-Treasurer, Frank DuWaldt.

Motion-picture films were exhibited on the *Jap Zero* and on *The Building of a Bomber*.

Stanford University

The organization meeting of the Stanford University Student Branch was held on November 9, at which the following officers were elected: Norman Green, Chairman; Henry Ponsford, Secretary; and Nicholas Van Dorn, Treasurer.

Eleven new members were initiated and two older members have returned to college.

The main part of the meeting on November 16 consisted of the showing of an educational motion picture produced by the N.A.C.A. at Langley Field titled *A Study of Air Flow by Means of Smoke*, which demonstrated the nature of lift and drag. The motion picture was followed by a short business meeting.

University of Texas

University of Texas Student Branch met on November 17, the program consisting of the showing of two motion pictures. The first was *All American*, showing American warplanes in action, and the second was a film showing the Sikorsky helicopter in flight.

On December 1 a lecture was given by Loren Dorman of the Curtiss-Wright Corporation on 'Aircraft Production Design Engineering." This was a description of the general organization of a production engineering department and of the difficulties overcome in the creation of designs that lend themselves readily to production.

Michael E. Gluhareff, formerly Chief of Design and Aerodynamics, is now Chief Engineer of the Sikorsky Division of United Aircraft Corporation.

News of I.A.S. Members

Gen. Henry H. Arnold, Commanding General of the Army Air Forces, received the Collier Trophy award for 1943, for his "organization and leadership of the Army Air Forces throughout the world." The presentation took place on December 17 at a dinner in Washington in honor of Orville Wright.

General Arnold also received the Poor Richard Club's Gold Medal of Achievement for 1943 on January 17, 1944, at the Club's 39th annual dinner in commemoration of the birth of Benjamin Franklin. General Arnold received this award for his accomplishments and "brilliant leadership" of the U.S. Army Air Forces.

Norman J. Asher joined the Army Air Forces as an Aviation Cadet.

George W. Baughman has been elected Eastern Division Chairman of the National Aircraft Standards Committee.

Carl Berg, Jr., is now an Aviation Machinist's Mate in the U.S. Navy.

Raymond L. Bisplinghoff was awarded his commission as an Ensign in the U.S. Naval Reserve.

Charles I. Blomer, having received a medical discharge from the U.S. Naval Reserve, has joined the Indiana Division of Republic Aviation Corporation.

Robert C. Clark has entered the employ of Eastern Aircraft Division of General Motors Corporation as a Stress Analyst.

Robert Henry Coven is a Private in the U.S. Army Air Forces.

Lee W. Crandell has been appointed Assistant Professor of Civil Engineering at the University of Colorado.

Carl T. Doman, formerly Vice-President and Chief Engineer of Aircooled Motors Corporation, was recently elected First Vice-President of the company.

Jerome Gropper is the new Eastern Vice-Chairman of National Aircraft Standards Committee.

Morgan A. Gunst, Jr., has joined the staff of the Radiation Laboratories at Massachusetts Institute of Technology.

Chester R. Haig, Jr., commissioned an Ensign, is now in the Structures Branch of the U.S. Navy.

Akira Hasegawa is on military leave, serving as a Sergeant in the U.S. Army.

Harvard L. Hull, formerly Chief Engineer at the Special Ordnance Plant of York Safe & Lock Company, has been appointed Research Director of the Clinton Engineer Works of Tennessee Eastman Corporation.

Willson H. Hunter is Chief of the Icing Research Division at the Aircraft Engine Research Laboratories of the N.A.C.A.

Edward J. King has joined Northrop Aircraft, Inc., as Test Engineer.

Edwin C. Kluga, recently commissioned a Lieutenant in the U.S. Army Air Forces, has been assigned as Flight Instructor at the Twin-Engine Advanced Flying School.

Charles B. Knox is a pilot and co-owner of the "K-T" Flying Service at Rodgers Airport, Hawaii.

Herbert C. Langmore is now a Project Engineer in the Hydraulic Research Laboratories of Bendix Aviation, Ltd., Division of Bendix Aviation Corporation.

Ward O. Mathews received his commission as an Ensign in the U.S. Naval Reserve.

Donald M. Mitchell, with the rank of Corporal, is taking a course in Mechanical Engineering in the Army Specialized Training Program at Purdue University.

Harold P. Moon is now Chief of Flight Research at the General Airborne Transportation Company.

Herbert A. Morris, on leave of absence from Curtiss-Wright, is serving as a Lieutenant in the U.S. Army Air Forces.

J. R. Goldstein, head of the newly formed Research Laboratories of Douglas Aircraft.

Serge Gluhareff has been promoted from Executive Engineer to Assistant Engineering Manager at the Sikorsky Division of United Aircraft Corporation.

James O'Neill has received his commission as an Ensign in the U.S. Naval Reserve.

Herbert W. Reed has been appointed Chief Project Engineer in the Aircraft Engineering Division of Designers for Industry, Inc.

Hans Reissner has joined the Faculty of the Polytechnic Institute of Brooklyn as Professor of Aerodynamics and Aeronautical Structures.

Bryce T. Ruley is a Stress Analyst with SKF Industries, Inc.

Norbert C. Schnaubelt is an Ensign in the U.S. Naval Reserve.

William W. Thomson has enlisted in the U.S. Army Air Corps.

Leonard Troy has transferred recently to Spartan Aircraft Company as an Aeronautical Stress Designer.

Richard R. Vineyard is the new Production Manager of Andover Kent Aviation Corporation.

John B. Wheatley, formerly Chief Development Engineer of The Glenn L. Martin Company, has been appointed Chief Research Engineer of the Aircraft Development Section of General Motors Corporation.

Shao W. Yuan is now Chief of Vibration in the Helicopter Division of McDonnell Aircraft Corporation.

Members Elected

The following applicants for membership or applicants for change of previous grade have been admitted to membership in the grades indicated since the publication of the list in the last issue of the REVIEW.

Transferred to Associate Fellow Grade

Bruhn, Elmer Frank, M.S.; Prof. of Aero. Engineering, Purdue Univ.

Lightfoot, Ralph B., B.S. in M.E.; Aerodynamic Flight Test & Research Engineer, Sikorsky Aircraft Div., United Aircraft Corp.

Elected to MEMBER Grade

Applegate, Frederick Daniel, Asst. Project Engineer, B-24, San Diego Div., Consolidated Vultee Aircraft Corp.

Avigdor, Rifat, Technical Director, Canadian Aircraft Instruments & Accessories Ltd.

Boericke, John James, Jr., Production Project Engineer, Fleetwings Div., Kaiser Cargo, Inc.

Boots, Norman Jay, B.S.; Pres., Boots Aircraft Nut Corp.

Brandt, Arthur John, B.S. in M.E.; Engineering Consultant to Chairman of Board, Consolidated Vultee Aircraft Corp.

Brannin, Richard S., B.S. in E.E.; Engineer, Sperry Gyroscope Co., Inc.

Brink, Glenn H., B.S. in Ae.E.; Chief Engineering Pilot, American Airlines, Inc.

Burnside, M. C., B.Sc.; Lt. Col., Area Supervisor, Matériel Command, U.S. Army Air Forces.

Colson, William J., B.S.; Field Engineer, Wright Aeronautical Corp.

DeVore, Gilbert, B.S. in M.E.; Project Engineer, Universal Moulded Products Corp.

Di Giovanni, Mario, B.S. in M.E.; Project Engineer, Development Div., Curtiss-Wright Corp.

Dobi, Nicholas S., Sr., M.E., Design & Research Engineer, Aircraft Div., Bartlett, Hayward Koppers Co.

du Plantier, Donald A., B.S. in C.E.; Chief of Structures, Consolidated Vultee Aircraft Corp.

Entz, Phillip Heasley, B.S. in E.E.; Stress Engineer, Wichita Div., Boeing Airplane Co.

Ervin, Augustus Law, Jr., B.S. in Ae.E.; Engineering Rep., Propeller Div., Curtiss-Wright Corp.

Freeman, Julien Walker, Aviation Supervisor, Shell Oil Co., Inc.

Gage, William Caleb, Zone Manager, Allison Div., General Motors Corp.

Griffin, William Raymond, M.S. in Math.; Member of Flutter Group, Airplane Div., Curtiss-Wright Corp.

Guzewicz, Edmund Anthony, B.S. in Ae.E.; Experimental Test Engineer, Pratt & Whitney Aircraft Div., United Aircraft Corp.

Haidle, Arthur Jesse, Meteorologist, Chief, Synoptic Reports Section, U.S. Weather Bureau.

Heng, Don, B.Ae.E.; Mgr., Aviation Northwest Div., The Pure Oil Co.

Hulse, Frank Wilson, B.S.; President, Southern Aviation Training School.

Irwin, Arthur Samuel, B.S.; Sr. Development Engineer, Bell Aircraft Corp.

Jaros, Zygmunt, M.M.E.; Supervising or Sr. Service Rep., Wright Aeronautical Corp.

Jones, Halsey Robinson, Field Engineer, Timken Roller Bearing Co.

Kuhn, Jackson Gotlieb, B.S.E.; Chief Engineer, Kinner Motors, Inc.

Liston, Joseph, M.E.; Assoc. Prof. of Aero. Engineering, Purdue Univ.

Lyon, Thoburn Cassady, Asst. Chief, Aero. Chart Branch, U.S. Coast & Geodetic Survey.

Lysak, W. W., B.S. in M.E.; Sr. Design Engineer, Sikorsky Aircraft Div., United Aircraft Corp.

Maier, Dwight Crisman, B.S. in C.E., M.E.; Chief Aero. Engineer, Aeronautical Products, Inc.

Mathews, John Allen, Chief Instructor, Spartan School of Aeronautics; Coordinator, Spartan Aircraft Co.

Mattson, Axel Ture, M.E.; Asst. Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

McCarty, J. E. D., B.S.; Ignition Development Engineer, Simmonds Aerocessories, Inc.

McGillivray, William Neil, Flight Lt., Production Development Officer, R.C.A.F.

Middleton, Ralph Edgar, B.S. in Ae.E.; Chief Engineer, Aircraft Accessories Corp.

Patterson, Richard F., Lt., U.S.N.R., Design Div. Engineering, Naval Aircraft Factory, Navy Yard, Phila.

Perrine, Charles Dillon, Jr., B.S.; Chief Radio Engineer Radio Div., Hughes Aircraft Co.

Peters, Earl Craswell, B.S. in M.E.; Design Engineer, Airplane Div., Curtiss-Wright Corp.

Peterson, Holger Martin, B.S. in E.E.; Asst. Chief Instructor, Training Command, U.S. Army Air Forces.

Remington, Kenneth D., Controls Design Specialist, Lockheed Aircraft Corp.

Renstrom, Arthur George, M.S.; Sr. Asst., Div. of Aero., Library of Congress.

Rose, William, Production Engineer, Taylor Fibre Co.

Ross, Ian Gibson, Experimental Test Pilot, The de Havilland Aircraft of Canada, Ltd.

Schroter, Bernard Herman, B.Sc. in E.E.; Squadron Leader, Chief Engineering Officer, R.C.A.F.

Seavey, Gordon C., B.S. in M.E.; Special Engineer, Aircooled Motors Corp.

Skramstad, Harold Kenneth, Ph.D.; Assoc. Physicist, National Bureau of Standards.

Smith, K. W., B.A.Sc.; Design Engineer, Victory Aircraft Ltd., Canada.

Stephens, Custis Gibson, Inspection Mgr., The Glenn L. Martin Co.

Stinson, William Evans, Sr. Development Engineer, Bell Aircraft Corp.

Sznycer, Bernard W., M.Ae.E.; Consulting Engineer.

Thompson, G. Stirling, B.S. in M.E.; Chief Designer, Fleetwings Div., Kaiser Cargo, Inc.

Torraco, Peter, B.S. in M.E.; Project Engineer, Republic Aviation Corp.

Turner, Roscoe, Col., Pres. & Gen. Mgr., Roscoe Turner Aeronautical Corp.

Vinci, Sam A., B.S. in E.E.; Group Engineer, Lockheed Aircraft Corp.

Vought, Harry, Jr., Lt. Comdr., Inspector of Naval Aircraft, U.S.N., Consolidated Vultee Aircraft Corp.

Vrooman, Carll DeWitt, B.S. in Ae.E.; Research Engineer, Lockheed Aircraft Corp.

Webster, David Locke, Ph.D; Prof., Chief Physicist Ordnance Dept., U.S. Army.

Williamson, John Dow, M.E.; District Manager, SKF Industries, Inc.

Yujuico, Pedro S., B.S. in M.E.; Development Engineer, Fairchild Aircraft Div., Fairchild Engine and Airplane Corp.

Transferred to MEMBER Grade

Abraham, Lewis Harry, B.S. in Ae.; Douglas Aircraft Co., Inc.

Barksdale, Lilburn Swisher, B.S. in M.E.; Chief Project Engineer, Adel Precision Products Corp.

Clark, Clayton Lincoln, B.Sc. in E.E.; Asst. Director of Inspection, Aircraft Div., Bechtel, McCone, Parsons.

Edwards, Milton F., Instructor in Aero. Engineering, Academy of Aeronautics.

Formhals, Edwin Jerome, B.S. in M.E.; Test Engineer, The Glenn L. Martin Co.

Israel, Marion Simon, B.S. in M.E.; Sr. Structures Engineer, Lockheed Aircraft Corp.

Mazzari, Hugo Leopold, M.S.; Inspector-in-Charge, Republic Aviation Corp.

Mitchell, Albert Edgar, Chief Draftsman, Aircraft Div., York Research Corp.

Elected to Industrial Member Grade

Anger, Rudolph, Master Mechanic, Supervisor of Inspection, Cargo Div., Hughes Aircraft Co.

Bellak, Theodore George, Director, Gliding, Soaring & Aero. Education, Minnesota State Aeronautics Commission.

Boyce, Harold Alexander, Capt. (Ret.); Vice-Pres., Century Precision Works, Inc.

Follett, Benjamin Branch, Jr., Sales-Research Engineer, Harvey-Wells Communications, Inc.

Gray, George Alphonse, Washington Sales Engineering Rep., Pesco Products Co.

Gribbon, Daniel Joseph, B.S. in Ae.E.; Asst. Mgr., Lockheed Aircraft Corp., England.

Hartman, A. J., Airport Mgr., Airport, Hartman Flying Service.

Lapp, Ray Henry, B.S. in Education; Supervisor-Material Procurement, Airplane Div., Curtiss-Wright Corp.

Morse, George Lavelle, A.B.; Field Engineer, Mine Safety Appliances Co.

Powell, Frank F., Coordinator-Factory Upgrading, Aero Industries Technical Institute.

Scott, W. F., Jr., Vice-Pres. & Gen. Mgr., Supply Div., Inc.

Sias, E. J., A.B.; Pres., Lincoln Aeronautical Institute & Lincoln Airplane Flying School.

Thompson, Cyril Clowes, Vice-Pres., United Air Lines Transport Corp.

Elected to Technical Member Grade

Ackerman, Wilbert Eiler, B.S. in Eng. Mech.; Vibration Engineer, Boeing Aircraft Co.

Adams, Guy Eugene, B.S. in M.E.; Aviation Cadet, U.S. Army Air Forces.

Ahearn, William C., Jr., B.S.; Inspector (Outside Procurement), Republic Aviation Corp.

Belsky, Fred Joseph, B.Ae.E.; Jr. Aerodynamicist, Eastern Aircraft Div., General Motors Corp.

I. A. S.

Honors Night Dinner

MONDAY, JANUARY 24, 7:00 P. M.

Grand Ballroom of the Hotel Waldorf-Astoria, New York

To avoid loss of time from business, the Council of the Institute has decided that the Honors Night Dinner for 1944 will be informal (Business Suits). This will allow members and their guests to come directly to the Dinner from their offices. Ladies are welcome.

The program will be as short as practicable so that members and guests will have ample time to visit after the Dinner. There will be no seating plan in order to facilitate starting the Dinner as quickly as possible.

Beltz, Robert Charles, B.S. in Ae.E.; Service Engineer, Lockheed Aircraft Corp.

Berthold, Cecil La Verne, B.S. in Ae.E.; Jr. Aero. Engineer, Ames Aero. Lab., N.A.C.A.

Best, Gilbert Copeland, Stress Analyst, Fairchild Aircraft Div., Fairchild Engine and Airplane Corp.

Binder, Charles Edward, Shop Contact Engineer, Sikorsky Aircraft Div., United Aircraft Corp.

Booker, Richard Armstead, Jr., Layout Draftsman, Kellett Aircraft Corp.

Breining, Aulden Joseph, B.S. in Ae.E.; Jr. Engineer, Airplane Div., Curtiss-Wright Corp.

Burdick, John S., Jr., B.S.; Jr. Engineer, Sikorsky Aircraft Div., United Aircraft Corp.

Cladis, George, Engineering Draftsman, Fairchild Aircraft Div., Fairchild Engine and Airplane Corp.

Compeau, Phillip Edward Charles, Weight Calculator, Bell Aircraft Corp.

Corner, Arthur N., B.S. in I.E.; Higgins Industries, Inc.

Dabrowski, Norbert Walter James, B.Ae.E.; Engineering Asst. "A," Douglas Aircraft Co., Inc.

Erdman, Francis Hickok, B.S. in M.E.; Sr. Engineer, Wright Aeronautical Corp.

Ferrell, Thomas Jefferson, Jr., Asst. Standards & Procedures Engineer, Airplane Div., Curtiss-Wright Corp.

Fromherz, Frank Charles, B.E. in C.E.; Jr. Stress Analyst, Goodyear Aircraft Corp.

Fuller, Donald Elbert, B-25 Coordination Engineer, North American Aviation, Inc.

Gant, Lloyd Ray, Resident Engineer, Universal Moulded Products Corp.

Gardner, William Norment, B.E. in Ae.E.; Stress Analyst, Airplane Div., Curtiss-Wright Corp.

Genovese, John Martin, Layout Draftsman, Chance Vought Aircraft Div., United Aircraft Corp.

Gibson, Edna M., B.S. in Psych., Jr. Analyst, Structural Test, Boeing Aircraft Co.

Gibson, Lowell C., B.S.; Lt. Comdr., U.S.C.G.; Tooling Staff Engineer, Boeing Aircraft Co.

Goldsmith, Irwin Robert, B.Ae.E.; Jr. Layout Draftsman, Simmonds Aerocessories, Inc.

Hipsh, Harold Marvin, Jr., Aerodynamic Analyst, Fisher Body Div., General Motors Corp.

Huff, Malvin, Chief Engineer, Empire Designing Co.

Jerger, Edward William, Aviation Cadet, U.S. Army Air Forces.

Karelitz, Joseph Abraham, B.S. in Ch.E.; Engineer, Research Dept., Universal Moulded Products Corp.

Konikoff, John J., M.E.; Asst. Aero. Engineer, Naval Aircraft Factory, Navy Yard, Phila.

Krell, John Henry, B.S. in M.E.; Structural Engineer, Brewster Aeronautical Corp.

Martin, Edward Francis, Jr., Jr. Design Engineer, Lockheed Aircraft Corp.

Nespolo, Virgil, Jr. Development Engineer, Goodyear Aircraft Corp.

Neumann, John E., B.S. in C.E.; Aerodynamics Group, Engineering Research Dept., Bell Aircraft Corp.

Newman, Leon, B.S. in Ae.E.; Project Engineer, Aircraft Div., Virginia-Lincoln Corp.

Ostrand, Arnold Oestreicher, M.S.; Aircraft Stress Analyst, Skydyne Inc.

Petrovsky, Alex, B.Ae.E.; Design Engineer, Grumman Aircraft Engineering Co.

Pheasey, Gordon Thomas, Instructor, Academy of Aeronautics.

Philbrick, Robert Davis, Sr. Layout Draftsman, The Emerson Electric Mfg. Co.

Reid, James Bryan, Sr. Layout Draftsman, The Emerson Electric Mfg. Co.

Ricci, Raymond, Jr. Engineer, Airplane Div., Curtiss-Wright Corp.

Rowley, Frederick Cannon, Eng. Test Pilot & Chief Flight Engineer, Fleetwings Div., Kaiser Cargo, Inc.

Sabin, Alfred Edward, B.S. in Ae.E.; Sr. Checker, Lockheed Aircraft Corp.

Schubert, William, B.S. in M.E.; Lt., U.S.N., Mechanical Engineer, Bureau of Aeronautics.

Smith, Gerald F., Jr. Stress Analyst, Northrop Aircraft, Inc.

Spacy, Warren B., Engineering Draftsman, Aerojet Engineering Co.

Swanson, Richard W., Chief, Navigation Training Section, Airline War Training Institute.

Thomason, Homer Spencer, Jr., B.S. in M.E.; General Test Engineer, Airplane Div., Curtiss-Wright Corp.

Thornburg, Francis LeRoy, Layout Draftsman, Consolidated Vultee Aircraft Corp.

Van Dyke, Milton Denman, B.S.; Jr. Engineer, Ames Aero. Lab., N.A.C.A.

Webb, Clifford Melvin, Project Engineer, Central Aircraft Ltd., Canada.

White, Eugene Hamilton, Aircraft Hydraulics Engineer, Adel Precision Products Corp.

Transferred from Student to Technical Member Grade

Ackerman, Morris, B.A.E.; Engineer's Asst., Ryan Aeronautical Co.

Audano, Peter Anthony, B.S. in Ae.E.; Aerodynamicist, Consolidated Vultee Aircraft Corp.

Barkley, William Buffington, B.S. in M.E.; Minor Layout Designer, Consolidated Vultee Aircraft Corp.

Beachy, Walter Aaron, Jr., B.S. in Ae.E.; Aero. Engineer, North American Aviation, Inc.

Belvedere, Abert Joseph, Jr., B.Ae.E.; Engineer, Cessna Aircraft Co.

Bond, Aleck Constantine, B.S. in Ae.E.; Jr. Engineer, Bell Aircraft Corp.

Breed, Carl H., B.S. in Ae.E.; Engineer, The Glenn L. Martin Co.

Brown, John Shillard, Aviation Cadet, U.S. Army Air Forces.

Carter, Edward Sterling, Jr., B.S. in Ae.E.; Research Associate, Princeton Univ.

Dhuysser, Edward, Cessna Aircraft Co.

Dreher, Robert Collins, Ae.E.; Airplane Mechanic, U.S. Army Air Forces.

Egbert, Douglas Tonne, Ae.E.; Aero. Engineer, North American Aviation, Inc.

Faget, Maxime Allan, B.S. in M.E.; Ensign, U.S.N.R

Fleming, William Adam, B.S. in Ae.E.; Aero. Engineer, Aircraft Engine Research Lab., N.A.C.A.

Fogel, Gerald Douglas, B.Ae.E.; Shop Contact Liaison Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Grieco, Anthony John, B.S. in Ae.E.; Design Engineer, Cessna Aircraft Co.

Hargis, Gordon Weaver, B.S.; 2nd Lt., U.S. Army Air Forces.

Harter, Wendel William, B.S.E.; Jr. Stress Engineer, Northrop Aircraft, Inc.

Henke, Richard Edward, B.S. in Ae.E.; Jr. Engineer, Boeing Aircraft Co.

Howland, Merville Chester, B.S. in Ae.E.; Asst. Instructor, Purdue Univ.

Kaufhold, Gerard William, Ae.E.; Stress Analyst, Fisher Body Div., General Motors Corp.

Kerr, Hans Irving, B.S. in Ae.E.; Asst. Instructor in Aero. Engineering, Purdue Univ.

Kosiak, Walter, M.E.; Stress Analyst, Consolidated Vultee Aircraft Corp.

Lowy, Stanley Howard, B.S. in Ae.E.; Aviation Cadet, U.S. Army Air Forces.

Mancusi, Louis Michael, B.S. in Ae.E.; Flight Test Engineer, Republic Aviation Corp.

McCormick, Gordon Hugh, B.A.E.; Aero. Engineer, Ryan Aeronautical Co.

Miller, Curtis Edward, B.S. in Ae.E.; Engineer, El Segundo Div., Douglas Aircraft Co., Inc.

Miller, Kenneth Dexter, Jr., B.S. in M.E.; Research Associate, Princeton Univ.

Muhlhauser, Alfred Eugene, Stress Analyst, Aeronca Aircraft Corp.

Patton, Robert James, Sergeant, U.S. Army.

Perevuznik, John, Jr., Jr. Aero. Engineer, Eastern Aircraft Div., General Motors Corp.

Riley, Claude Frank, Jr., B.S. in G.E.; 2nd Lt., U.S. Marine Corps.

Ritter, Alfred, B.S. in Ae.E.

Roberts, William Harrison, Aero. Engineer, North American Aviation, Inc.

Sheiner, Arthur, Aero. Engineer, Eastern Aircraft Div., General Motors Corp.

Sorensen, Joseph Malcolm, Ae.E.; Asst. Flight Engineer, Northwest Airlines, Inc.

Sullivan, James Anthony, Jr. Engineer, Eastern Aircraft Div., General Motors Corp.

Swenson, Everitt Victor, B.S. in Ae.E.; Apprentice Engineer, Panair do Brasil.

Trimpi, Richard Hulse, Asst. Engineer, American Airlines, Inc.

Wasserman, Bernard, B.S. in Ae.E.; Structural Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Wetzel, James E., B.S.; Layout Draftsman, Consolidated Vultee Aircraft Corp.

Winters, Leo Herman, B.S. in Ae.E.; Stress Analyst, Consolidated Vultee Aircraft Corp.

Zimney, Charles Marshall, B.S. in Ae.E.; Jr. Aero Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Elected to Affiliate Grade

Ackerman, Meyer, Corp., Link Trainer Instructor, U.S. Army Air Forces.

Blodgett, Randolph Chandler, Ph.D.; Teacher of Math. & Aero., Glen Ridge High School.

Burgess, George Wadsworth, A.B.; Asst. to W. A. M. Burden, who is Asst. to the Secretary of Commerce, Dept. of Commerce.

Piecewicz, Charles Teofil, B.S.E.; Physicist, E. I. du Pont de Nemours & Co.

Rosenthal, Gordon, Lab. Asst., Aerodynamics Section, National Research Council of Canada.

Russo, Bennie Joseph, Service Engineer, Fleetwings Div., Kaiser Cargo, Inc.

Tarasewich, Michael, Engineering Draftsman Gruman Aircraft Engineering Corp.

Necrology

Hubert Charles Henry Townend

Hubert Charles Henry Townend, a Fellow of the Institute of the Aeronautical Sciences and a Fellow of The Royal Aeronautical Society, lost his life in an airplane accident in England. The date of his death and the cause of the accident are not known in this country at the time. At the time of his death he was connected with the Department of Scientific Research and Experiments of the British Admiralty.

Dr. Townend had had a long and distinguished career in aeronautics. He was born in London on March 18, 1896, received his early education privately and earned the degrees of Bachelor of Science and Doctor of Science in Engineering at London University. He was an observer with the Royal Air Force in 1918, serving in Palestine, and had been engaged in aeronautical research at the National Physical Laboratories since 1923. He was the inventor of the Townend ring cowling for radial engines and introduced the hot wire and spark methods of airflow photography and cinematography. In 1931 he was awarded the Silver Medal of The Royal Aeronautical Society.

An extensive list of technical articles was written by Dr. Townend, these having appeared in numerous technical magazines including the *Journal of the Royal Aeronautical Society* and as official reports published by various divisions of the British Government.

Philip Searle Farnsworth

Philip Searle Farnsworth, Standards Engineer at Pratt & Whitney Aircraft Division of United Aircraft Corporation, died in the latter part of November. He was a native of Ludlow, Mass., where he was born on October 6, 1905.

Mr. Farnsworth attended Boston University. His entire career was devoted to the Pratt & Whitney organization, which he joined on April 6, 1926. He was responsible for all standardization activities of the company, directing all work related to the establishment of engineering standards and the preparation, editing, and publication of various information, including material specifications, standard parts manuals, design and drafting manuals, and related data.

(*Continued on page 183*)

Institute of the Aeronautical Sciences Twelfth Annual Meeting

January 25 to 27, 1944

TENTATIVE PROGRAM

All Technical Sessions will be held in the Pupin Physics Laboratories, Columbia University, 120th Street and Broadway, New York

To facilitate announcing the technical sessions of the Twelfth Annual Meeting, the program given is a complete listing of all papers submitted and tentatively accepted by the meetings committee.

In the interest of our members and guests, it has been decided that all technical sessions will be open meetings. For this reason, circumstances beyond the control of the Institute may cause the withdrawal of certain papers from the program. The final program will list only those papers definitely scheduled.

Individuals desiring preprints of papers for personal use should make their requests directly to the authors of the papers desired.

Tuesday January 25

AIRCRAFT PRODUCTION

1:30 p.m. **Room 401**

Chairman

Frederic Flader, Airplane Division, Buffalo Plants, Curtiss-Wright Corporation

Resin Adhesives for Aircraft—Henry Grinsfelder and Thomas D. Perry, The Resinous Products & Chemical Company, Inc.

The Trend of Wood Use in Aircraft—R. W. Hess, Airplane Division, Buffalo Plants, Curtiss-Wright Corporation.

Demagnetization During Magnetic Particle Inspection—M. Mages, Magnaflux Corporation.

The Use of Plastics for Aircraft Tooling—Leonard Weiss, Brewster Aeronautical Corporation.

STRUCTURES

1:30 p.m. **Room 428**

Chairman

Walter Ramberg, National Bureau of Standards

Three Dimensional Analysis of Engine Mount Rings by a Strain Energy Method—Charles E. Mack, Jr., Grumman Aircraft Engineering Corporation.

Plastic Bending—William R. Osgood, National Bureau of Standards.

Preliminary Structural Analysis and Weight Investigation of Wings—Fletcher N. Platt, Fleetwings Division, Kaiser Cargo, Inc.

Flexural Strength in the Plastic Range of Rectangular Magnesium Extrusions—F. A. Rappleyea and E. J. Eastman, The Dow Chemical Company.

Buckling Loads of Beams or Plates on Continuous Supports—Edward Saibel, Carnegie Institute of Technology.

DINNER **6 p.m.**

Columbia University Men's Faculty Club

AIR TRANSPORT

7:30 p.m. **Room 401**

Chairman

John C. Leslie, Pan American Airways, Inc.

Traffic Control Problems for Future Airports—M. G. Beard, American Airlines, Inc.

Daylight Training of Pilots for Night Flying—J. G. Beebe-Center, L. Carmichael, and L. C. Mead, Tufts College.

The Correlation of Aircraft Takeoff and Landing Characteristics with Airport Size—A. L. Morse, Civil Aeronautics Administration.

Aircraft Hangars and Terminal Buildings of Reinforced Concrete—Charles S. Whitney, Consulting Engineer.

MATERIALS

7:30 p.m. **Room 428**

Chairman

George W. DeBell, Consulting Engineer

High Strength Casting Alloy With Natural Re-aging Properties—Hiram Brown, Frontier Bronze Corporation.

REGISTRATION FEES

A registration fee of $1.00 for members of the Institute and $2.00 for nonmembers will be charged to partially defray meeting expenses. This fee will be for the entire three-day meeting.

Parts from Metal Powders—Carl Claus, Bound Brook Oil-Less Bearing Company.

Artificial Aging and Stretching 24S Aluminum Alloy—Thomas H. Huff, Brasco Manufacturing Company.

New Wrought Aluminum Alloys for Aircraft and New Temper Modifications of Present Alloys—D. A. Lawless, Reynolds Metals Company.

Indium in Aviation—William S. Murray, The Indium Corporation of America.

Wednesday January 26

AERODYNAMICS, Part I

1:30 p.m. **Room 401**

Chairman

Richard H. Smith

Massachusetts Institute of Technology

Calculated Gust Loads for Tailless Airplanes—R. F. Anderson, Lockheed Aircraft Corporation.

The Influence of Structural Deformation on Aerodynamic Characteristics of the Airplane—A. Flax, Airplane Division, Buffalo Plants, Curtiss-Wright Corporation.

The Interference of the Fuselage on the Propellers of a Multi-Engine Airplane in Yawed Flight—R. P. Harrington and Victor Zadikov, Polytechnic Institute of Brooklyn.

Some Two Dimensional Adiabatic Compressible Flow Patterns—Hans Kraft and Charles G. Dibble, General Electric Company.

Drag of Airfoils in Grids of High Solidity—John R. Weske, Case School of Applied Science.

RADIO AND INSTRUMENTS

1:30 p.m. **Room 428**

Chairman

Alan G. Binnie

Kollsman Instrument Division, Square D Company

Flight Research Instrumentation of the Single Seat Fighter—Stephen B. Elggren, Bell Aircraft Corporation.

Development of Stall Warning Indicators—James George, Civil Aeronautics Administration.

The Electronic Turboregulator—W. Gille, Minneapolis-Honeywell Regulator Company.

Aircraft Remote Controls and Automatic Controls—W. P. Lear, Lear Avia, Inc.

Measurement of Rate of Flow by Means of an Oscillating Vane—P. Weiller and Victor E. Carbonara, Kollsman Instrument Division, Square D Company.

ANNUAL BUSINESS MEETING

5:00 p.m. **Room 401**

Reports of Officers and Election of Council Members

DINNER **6 p.m.**

Columbia University Men's Faculty Club

AERODYNAMICS, Part II

7:30 p.m. **Room 401**

Chairman

R. P. Harrington, Polytechnic Institute of Brooklyn

The Thermodynamics of Air at High Velocities—Neil P. Bailey, General Electric Company.

Effect of Dive Brakes on Airfoil and Airplane Characteristics—Philip G. Blenkush, University of Detroit.

Instrument for the Exploration and Measurement of Areas of Vorticity—J. Chvosta and John J. Jaclitch, Case School of Applied Science.

Investigation of the Wing-Wake Frequency with Application of the Strouhal Number—Zbigniew Krzywoblocki, Polytechnic Institute of Brooklyn.

Hydrodynamic Landing Instability—Ernest G. Stout, Consolidated Vultee Aircraft Corporation.

POWER PLANTS AND PROPELLERS

7:30 p.m. **Room 428**

Chairman

George W. Brady

Propeller Division, Curtiss-Wright Corporation

Stability of a System Acted upon by a Plurality of Co-acting Automatic Controls—C. W. Chillson, R. J. Kochenburger, and P. J. Quinn, Propeller Division, Curtiss-Wright Corporation.

Aircraft Powerplant Fire Protection—H. L. Hansberry, Civil Aeronautics Administration.

The Theory of the Centrifugally Tuned Vibration Absorber—Ralph J. Harker, Hamilton Standard Propellers Division, United Aircraft Corporation.

Application of the Variable Ratio V-Belt Principle in the Design of a Constant Speed Propeller—Lloyd H. Leonard, Aircraft Specialties Division, Zimmer-Thomson Corporation.

Propeller Design Requirements—H. M. McCoy, Propeller Laboratory, Engineering Division, Matériel Command, U.S. Army Air Forces, Wright Field.

Thursday January 27

AIRPLANE DESIGN

1:30 p.m. **Room 401**

Chairman

Charles J. McCarthy, United Aircraft Corporation

Soundproofing of Military Aircraft—Albert A. Arnhym, Solar Aircraft Company.

Aircraft Industry French Technique 1941-42—Alex M. Gorfin, Matam Corporation.

Radiant Energy Exchange as a Factor in Airplane Cabin Heating—F. W. Hutchinson and B. F. Raber, University of California.

Directional Stability of Flying Boat Hulls During Taxiing—John D. Pierson, The Glenn L. Martin Company.

Impact Resistant Windshield Construction—G. L. Pigman, Civil Aeronautics Administration.

METEOROLOGY

Session Prepared in Cooperation with the American Meteorological Society

1:30 p.m. **Room 428**

Chairman

C. E. Buell, American Airlines, Inc.

Methods of Estimating or Determining the Heights and Motions of Clouds—Charles F. Brooks, Blue Hill Observatory, Harvard University.

Causes of Nighttime Thunderstorms Over the Middle West—Donald M. Crowley, Transcontinental & Western Air, Inc.

Improved Techniques for Pressure, Temperature and Humidity Observations—S. P. Fergusson, Blue Hill Observatory, Harvard University.

On the Significance of Correlations of Large Scale Circulations and Computation of the Correlation Coefficients—Irving I. Schell, Blue Hill Observatory, Harvard University.

DINNER 6 p.m.

Columbia University Men's Faculty Club

ROTATING WING AIRCRAFT

7:30 p.m. **Room 401**

Chairman

R. H. Prewitt, Kellett Aircraft Corporation

A Direct Method of Calculating the Maximum Rate of Climb, Top Speed, and the Other Useful Performance Characteristics of a Helicopter in Powered Flight—Walter Castles, Jr., Aviation Engineering, Inc.

The Response of Articulated Rotor Helicopters to Cyclic Blade Pitch Control—A. F. Donovan and M. Goland, Airplane Division, Buffalo Plants, Curtiss-Wright Corporation.

Aerodynamic Instability in Unbalanced Lifting Rotor Blades—Reinhardt M. Rosenberg, Bell Aircraft Corporation.

FILMS

PV-2 Helicopter—Frank Piasecki, P-V Engineering Forum.

The Sikorsky Helicopter—Igor I. Sikorsky, Sikorsky Aircraft Division, United Aircraft Corporation.

Recent Progress on the Bell Helicopters—Arthur M. Young, Bell Aircraft Corporation.

(Continued on page 180)

Personnel Opportunities

This column is for the use of individual members of the Institute seeking new connections and organizations offering employment to aeronautical specialists. Any member or organization may have requirements listed without charge by writing to the Secretary of the Institute.

WANTED

Aeronautical Engineers urgently needed by Consolidated Vultee Aircraft Corporation, Fort Worth Division, to execute program of extensive development of large aircraft. Applicant must have technical training and not presently employed in essential war industries. Apply direct to 921 Lamar Street, Fort Worth, Tex.

Graduate Engineers for essential war work, opportunity for advancement and increased earnings. Aeronautical experience not necessary. Must be citizen not employed in essential war industry or have certificate of availability from the U.S. Employment Service Office or War Manpower Commission of your area. Write direct, stating school, age, degree, experience, draft classification, and marital status to Consolidated Vultee Aircraft Corporation, Industrial Training Division, San Diego, Calif.

Engineer—Aeronautical or Mechanical—to establish and conduct complete test program on Army Air Force helicopter. Program will include all types of testing to determine airworthiness and functioning of component parts, including bench, fatigue, structural, resonance, and flight operational tests, as well as design of necessary test equipment. Excellent opportunity for advancement in new development program. Requires able and aggressive engineer with force and foresight. Must be citizen and be able to secure certificate of availability. Write, giving full particulars including draft status to Administrative Engineer, Kellett Aircraft Corporation, Plant No. 2, Upper Darby, Pa.

Aircraft Engineers needed by a progressive aircraft company with openings for group engineers to cover hydraulics, landing gear, and controls. Also positions available for a materials and process engineer, service engineer, procedures engineer, and several aircraft checkers. Those presently employed in essential war work need not apply. Airmail complete detailed information regarding education, experience, salaries, former employers, age, family status, citizenship, draft status, in order that we may be able to evaluate your qualifications from the first letter. Higgins Aircraft, Inc., P. O. Box 32, New Orleans 6, La.

AVAILABLE

Aeronautical Engineer recently discharged Army Air Forces, formerly executive Chief Engineer and Consultant, desires new connections either permanent or consulting. Address inquiries to Box 205, Institute of the Aeronautical Sciences.

Aeronautical Engineer, B.S. in M.E. (Aero Option), with over 4 years' experience in design and supervision wishes to become associated with a consulting engineer or group in the Philadelphia area. Address inquiries to Box 202, Institute of the Aeronautical Sciences.

Test Pilot, research minded, seeks new connection preferably in experimental or development work. Address inquiries to Box 201, Institute of the Aeronautical Sciences.

Aeronautical Engineer, B.S. in Ae.E., age 26, 2 years' experience stress analyst and structural engineer with Navy Department; possesses valid commercial, instructor, instrument and 675-hp. ratings; 1,300 hours' time. Desires position involving flight engineering and testing. Address inquiries to Box 200, Institute of the Aeronautical Sciences.

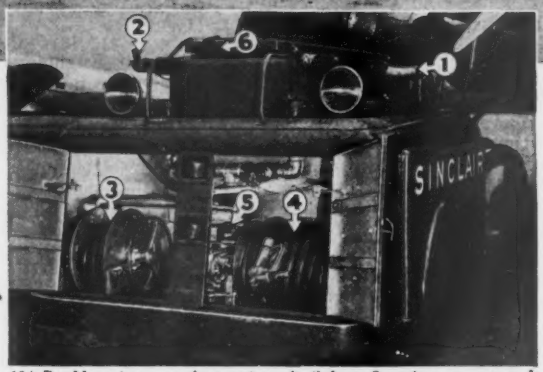
Engineer, 15 years' experience as aeronautical, automotive, and air-conditioning engineer; until recently supervisor of important liaison work in engineering department of major aircraft manufacturer; at present doing graduate work in air transport field while acting as supervising research engineer on war project at University; desires connection in air transport field. Address inquiries to Box 199, Institute of the Aeronautical Sciences.

Graduate Engineer, 10 years' practical experience in design and development of aircraft armament including power-operated gun turrets; 50-caliber and 20-mm. fixed installations. Experience obtained with leading American and British Gun Turret Builders; desires position as Design Engineer or Executive with progressive aircraft concern. Address inquiries to Box 198, Institute of the Aeronautical Sciences.

Structural Aeronautical Engineer, 20 years' military and commercial aircraft engineering, including design supervision, liaison, and coordination. Desires responsible project or position as engineering representative on large cargo planes. Draft status does not effect change. Available in 30 days. Address inquiries to Box 194, Institute of the Aeronautical Sciences.

Aeronautical Engineer, M.I.T. graduate, age 37, 14 years' practical and well-rounded experience on aircraft design, supervision, executive, wide organization background. Held positions as project engineer, assistant chief engineer, chief aeronautical engineer. Desires permanent position as chief engineer or similar. Willing to go into partnership. Location preferred, Los Angeles or extended area, or South America. Address inquiries to Box 153, Institute of the Aeronautical Sciences.

Speeding The Ground Service—



(1) Double swing arms for suction of oil from 2 engines at once and (2) quick coupling ends; (3) 30-ft. suction hose for hard-to-reach drainings; (4) 50-ft. new oil hose reel; (5) motor and tank gauges; (6) hydraulic elevating and positioning platform for servicing ships.

Fast ground servicing despite manpower shortage is a wartime problem of air transportation.

The new Sinclair Oil-Jeep helps American Airlines in their man-hour and ground-time saving program. An aerial, hydraulic positioning platform permits speedy servicing of the largest airplane without ladders or "monkey-climbing" over de-icers and wings.

The Oil-Jeep handles all services—both new and used oil. Two, or even three engines may be drained simultaneously and refilled without moving the Oil-Jeep.

American Airlines now has new service honors—the 1942 *Aviation* Award for "outstanding maintenance performance." Every mile of flying by its great Flagship fleet is lubricated by Sinclair Pennsylvania Motor Oil.

FOR FURTHER INFORMATION ABOUT SINCLAIR PENNSYLVANIA AND OTHER SINCLAIR AIRCRAFT LUBRICANTS WRITE

SINCLAIR AVIATION OILS

SINCLAIR REFINING COMPANY (Inc.)

Rialto Bldg. Kansas City • 2540 West Cermak Road Chicago • Fair Building Ft. Worth • 10 West 51st Street New York City • 573 West Peachtree Street Atlanta